



# FCC RADIO TEST REPORT

**FCC ID** : UZ7MC330X  
**Equipment** : Mobile Computer  
**Brand Name** : Zebra  
**Model Name** : MC330X  
**Applicant** : Zebra Technologies Corporation  
1 Zebra Plaza, Holtsville, NY 11742  
**Manufacturer** : Zebra Technologies Corporation  
1 Zebra Plaza, Holtsville, NY 11742  
**Standard** : FCC Part 15 Subpart C §15.247

The product was received on Apr. 06, 2021 and testing was started from Apr. 06, 2021 and completed on Jun. 08, 2021. We, Sporton International Inc. Wensan Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Approved by: Louis Wu

**Sporton International Inc. Wensan Laboratory**

No. 58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)



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### History of this test report

Report No.	Version	Description	Issued Date
FR131009-01C	01	Initial issue of report	Jun. 30, 2021



## Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(2)	6dB Bandwidth	Pass	-
3.1	2.1049	99% Occupied Bandwidth	Reporting only	-
3.2	15.247(b)	Power Output Measurement	Pass	-
3.3	15.247(e)	Power Spectral Density	Pass	-
3.4	15.247(d)	Conducted Band Edges	Pass	-
		Conducted Spurious Emission	Pass	-
3.5	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	Under limit 1.13 dB at 2390.000 MHz
3.6	15.207	AC Conducted Emission	Pass	Under limit 13.76 dB at 13.560 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	Pass	-

**Declaration of Conformity:**

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

**Comments and Explanations:**

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

**Reviewed by: Wei Chen**

**Report Producer: Lucy Wu**



# 1 General Description

## 1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Computer
Brand Name	Zebra
Model Name	MC330X
FCC ID	UZ7MC330X
SKU 1	Gun 29key
SKU 2	Gun 38key
SKU 3	Gun 47key
SKU 4	Brick 29key SE4850
SKU 5	Brick 38key
SKU 6	Brick 47key
SKU 7	Brick 29key SE4770
EUT supports Radios application	NFC WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 WLAN 11ax HE20/HE40/HE80 Bluetooth BR/EDR/LE
HW Version	EV
SW Version	Android Version 11
FW Version	11-10-12.00-RG-U00-PRD-HEL-04
MFD	20MAR21
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer.

Specification of Accessories				
Adapter	Brand Name	Zebra	Part Number	PWR-WUA5V12W0US
U cable	Brand Name	Symbol	Model Name	CBL-MC33-USBCHG-01
MC33 1X battery (Inventus)	Brand Name	ZEBRA	Model Number	BT-000338
MC33 2X battery (Inventus)	Brand Name	ZEBRA	Model Number	BT-000337
MC33 2X battery (TWS)	Brand Name	ZEBRA	Model Number	BT-000337A
MC33 7000mA 2X (Inventus)	Brand Name	ZEBRA	Model Number	BT-000375
MC33 Extended Capacity Battery (BT Battery)	Brand Name	ZEBRA	Model Number	BT-000444
Holster for MC3XXX Gun configuration	Brand Name	Zebra	Model Number	SG-MC3021212-01R
Rigid holster for MC3XXX Gun configuration	Brand Name	Zebra	Model Number	SG-MC33-RDHLST-01
Holster for MC3XXXX Brick configuration	Brand Name	Zebra	Model Number	11-69293-01R
Rigid holster for MC3XXX Brick configuration	Brand Name	Zebra	Model Number	SG-MC33-RDHLST-01

## 1.2 Product Specification of Equipment Under Test

Product Specification subjective to this standard										
<b>Tx/Rx Channel Frequency Range</b>	2412 MHz ~ 2462 MHz									
<b>Maximum Output Power to Antenna &lt;CDD Modes&gt;</b>	<b>MIMO &lt;Ant. 1+2&gt;</b> 802.11b : 22.21 dBm / 0.1663 W 802.11g : 20.44 dBm / 0.1107 W 802.11n HT20 : 21.35 dBm / 0.1365 W 802.11ac VHT20: 21.45 dBm / 0.1396 W 802.11ax HE20: 21.30 dBm / 0.1349 W									
<b>Maximum Output Power &lt;TXBF Modes&gt;</b>	<b>MIMO &lt;Ant. 1+2&gt;</b> 802.11ac VHT20: 20.31 dBm / 0.1074 W									
<b>99% Occupied Bandwidth &lt;CDD Mode&gt;</b>	<b>MIMO &lt;Ant. 1&gt;</b> 802.11b: 11.49 MHz 802.11g: 17.18 MHz 802.11ac VHT20: 18.23 MHz <b>MIMO &lt;Ant. 2&gt;</b> 802.11b: 11.49 MHz 802.11g: 17.08 MHz 802.11ac VHT20: 18.08 MHz									
<b>99% Occupied Bandwidth &lt;TXBF Mode&gt;</b>	<b>MIMO &lt;Ant. 1&gt;</b> 802.11ac VHT20: 18.08 MHz <b>MIMO &lt;Ant. 2&gt;</b> 802.11ac VHT20: 18.08 MHz									
<b>Antenna Type / Gain</b>	<b>Ant. 1:</b> Patch Antenna with gain 3.10 dBi <b>Ant. 2:</b> Patch Antenna with gain 3.10 dBi									
<b>Type of Modulation</b>	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM) 802.11ax: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM / 1024QAM)									
<b>Antenna Function Description</b>	<table border="1"> <thead> <tr> <th></th> <th>Ant. 1</th> <th>Ant. 2</th> </tr> </thead> <tbody> <tr> <td>802.11 b/g/n/ac/ax MIMO</td> <td>V</td> <td>V</td> </tr> <tr> <td>802.11 ac TXBF</td> <td>V</td> <td>V</td> </tr> </tbody> </table>		Ant. 1	Ant. 2	802.11 b/g/n/ac/ax MIMO	V	V	802.11 ac TXBF	V	V
	Ant. 1	Ant. 2								
802.11 b/g/n/ac/ax MIMO	V	V								
802.11 ac TXBF	V	V								

**Note:**

1. MIMO Ant. 1+2 is a calculated result from sum of the power MIMO Ant. 1 and MIMO Ant. 2.
2. The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

## 1.3 Modification of EUT

No modifications are made to the EUT during all test items.



### 1.4 Testing Location

<b>Test Site</b>	Sporton International Inc. Wensan Laboratory
<b>Test Site Location</b>	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
<b>Test Site No.</b>	<b>Sporton Site No.</b> TH05-HY, CO07-HY, 03CH16-HY

**Note:** The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW3786

### 1.5 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC Part 15 Subpart C §15.247
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01.
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ♦ ANSI C63.10-2013

**Remark:**

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.
3. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



## 2 Test Configuration of Equipment Under Test

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report.
  
- b. AC power line Conducted Emission was tested under maximum output power.

### 2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		





## 2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

### CDD Mode

Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20 (Covered by VHT20)	MCS0
802.11ac VHT20	MCS0
802.11ax HE20	MCS0

### TXBF Mode

Modulation	Data Rate
802.11ac VHT20	MCS0

Test Cases	
<b>AC Conducted Emission</b>	Mode 1 :WLAN (2.4GHz) Link + Bluetooth Link + Play MP3 + NFC On + MC33 Extended Capacity Battery (BT Battery) + U cable (Charging from Adapter) for SKU 7
<b>Remark:</b> For Radiated Test Cases, the tests were performed with MC33 1X battery (Inventus) and SKU 1 and SKU 3.	

### <CDD Mode>

Ch. #	2400-2483.5 MHz			
	802.11b	802.11g	802.11ac VHT20	802.11ax HE20
Low	01	01	01	01
Middle	06	06	06	-
High	11	11	11	11

### <TXBF Mode>

Ch. #	2400-2483.5 MHz
	802.11ac VHT20
Low	01
Middle	06
High	11

**Remark:** For radiation spurious emission, the final modulation and the worst data rate was reference the max RF conducted power.



<CDD Mode>

MIMO <Ant. 1+2>

802.11b RF Avg Output Power (dBm)						
Power vs. Channel			Power vs Data Rate			
Channel	Frequency (MHz)	Data Rate (bps)	Channel	Data Rate (bps)		
		1M		2M	5.5M	11M
CH 01	2412	21.51	CH 06	22.11	22.11	22.11
CH 06	2437	22.21				
CH 11	2462	21.16				

802.11g RF Avg Output Power (dBm)									
Power vs. Channel			Power vs Data Rate						
Channel	Frequency (MHz)	Data Rate (bps)	Channel	Data Rate (bps)					
		6M		9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps
CH 01	2412	18.07	CH 06	20.34	20.34	20.34	20.34	20.34	20.34
CH 06	2437	20.44							
CH 11	2462	16.66							

802.11n HT20 RF Avg Output Power (dBm)									
Power vs. Channel			Power vs Data Rate						
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index					
		MCS0		MCS1	MCS2	MCS3	MCS4	MCS5	MCS6
CH 01	2412	18.67	CH 06	21.25	21.25	21.25	21.25	21.25	21.25
CH 06	2437	21.35							
CH 11	2462	14.48							



802.11ac VHT20 RF Avg Output Power (dBm)											
Power vs. Channel			Power vs Data Rate								
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index							
		MCS 0		MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8
CH 01	2412	18.77	CH 06	21.35	21.35	21.35	21.35	21.35	21.35	21.35	21.35
CH 06	2437	21.45									
CH 11	2462	14.58									

802.11ax HE20 RF Avg Output Power (dBm)															
Power vs. Channel				Power vs Data Rate											
Channel	Frequency (MHz)	RU Config.	MCS Index	Channel	MCS Index										
			MCS 0		MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS 10	MCS 11
CH 01	2412	Full	18.47	CH 06	21.20	21.20	21.20	21.20	21.20	21.20	21.20	21.20	21.20	21.20	
CH 01	2412	26/0	10.34												
CH 01	2412	52/37	13.19												
CH 01	2412	106/53	16.27												
CH 06	2437	Full	21.30												
CH 06	2437	26/4	11.64												
CH 06	2437	52/39	15.65												
CH 06	2437	106/53	18.37												
CH 11	2462	Full	14.44												
CH 11	2462	26/8	6.28												
CH 11	2462	52/40	9.46												
CH 11	2462	106/54	11.77												

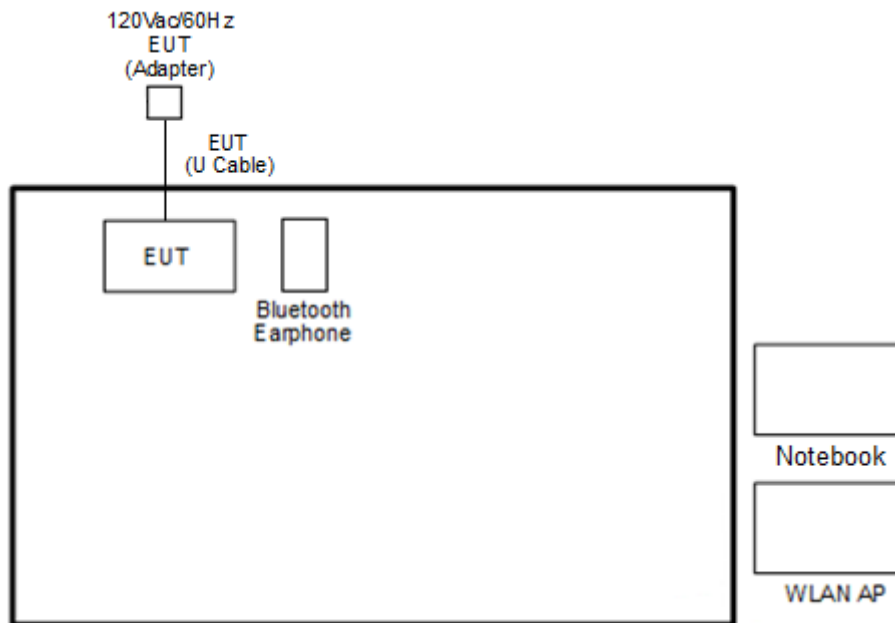
<TXBF Mode>

MIMO <Ant. 1+2>

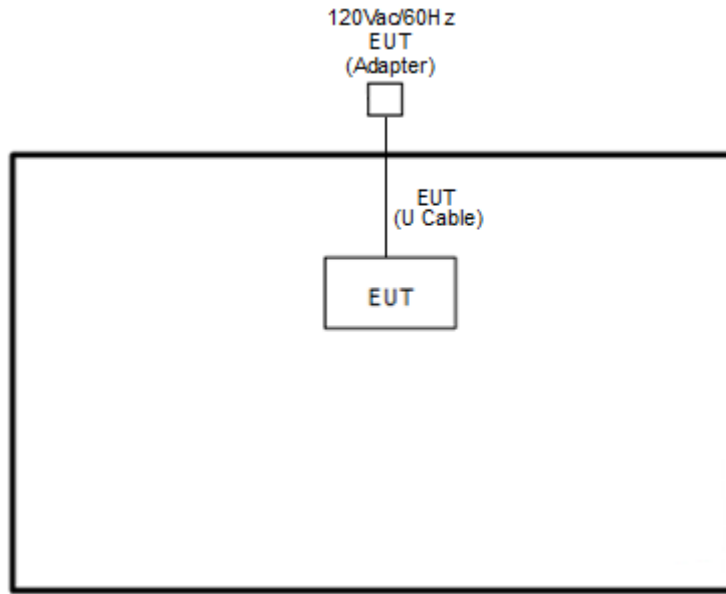
802.11ac VHT20 RF Avg Output Power (dBm)												
Power vs. Channel			Power vs Data Rate									
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index								
		MCS 0		MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	
CH 01	2412	16.62	CH 06	20.21	20.16	20.16	20.16	20.16	20.16	20.21	20.21	20.16
CH 06	2437	20.31										
CH 11	2462	12.67										

### 2.3 Connection Diagram of Test System

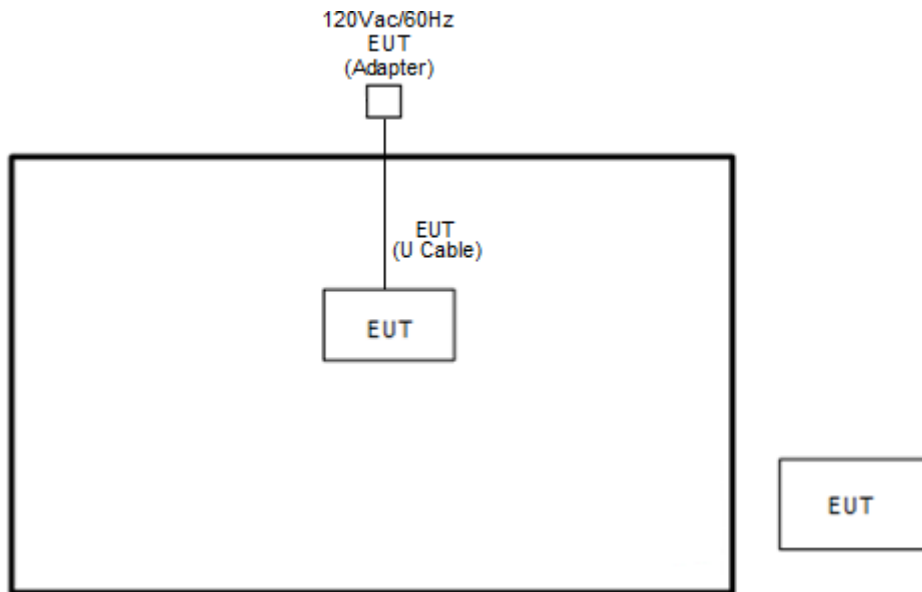
<AC Conducted Emission Mode>



<CDD Mode>



<TXBF Mode>



## 2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Earphone	Lenovo	LBH301	FCC DoC	N/A	N/A
2.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8 m
3.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A
4.	Notebook	DELL	Latitude 3400	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

## 2.5 EUT Operation Test Setup

The RF test items, utility “Command V10.0.16299.1087” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

For TXBF mode, the modulation modes and data rates manipulated by the command lines in the engineering program made the EUT link to another EUT by power under the normal operation. The “Command & Magic Iperf V1.0” software tool was used to enable the EUT to transmit signals continuously.

## 2.6 Measurement Results Explanation Example

**For all conducted test items:**

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

*Offset = RF cable loss + attenuator factor.*

Following shows an offset computation example with cable loss 4.2 dB and 10 dB attenuator.

$$\begin{aligned}
 \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\
 &= 4.2 + 10 = 14.2 \text{ (dB)}
 \end{aligned}$$

### 3 Test Result

#### 3.1 6dB and 99% Bandwidth Measurement

##### 3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

##### 3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

##### 3.1.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW)  $\geq 3 * RBW$ .
6. Measure and record the results in the test report.

##### 3.1.4 Test Setup



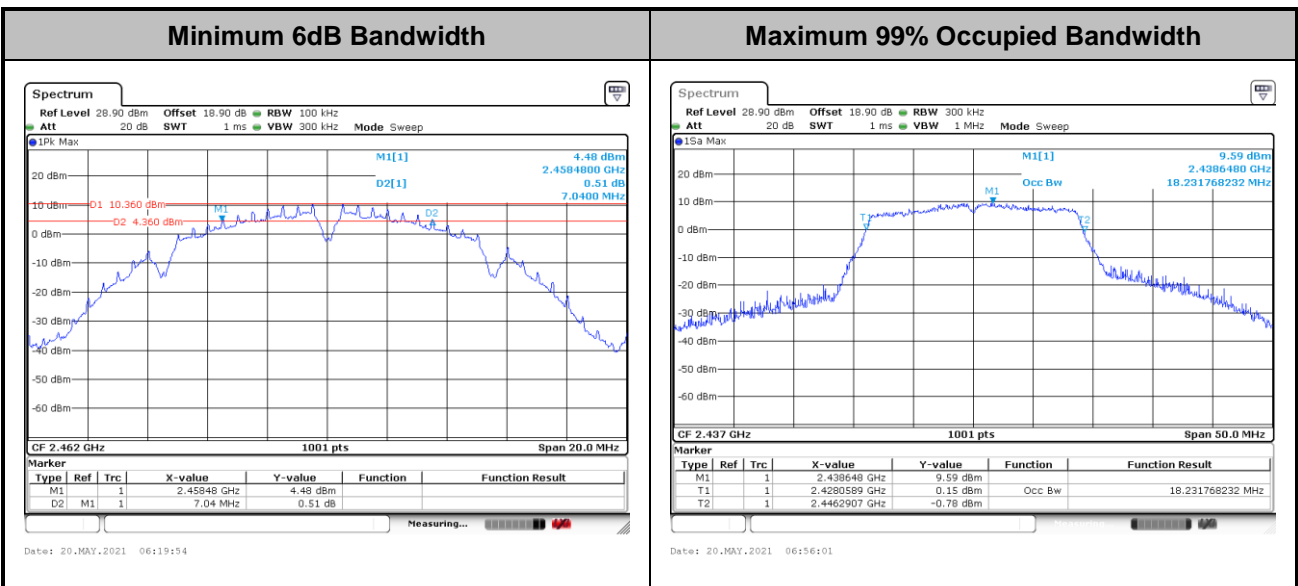


3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

<CDD Mode>

Test Engineer :	Hank Hsu and Ching Chen	Temperature :	21~25°C
		Relative Humidity :	51~54%

2.4GHz Band MIMO										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)		6dB BW (MHz)		6dB BW Limit (MHz)	Pass/Fail
					Ant1	Ant2	Ant1	Ant2		
11b	1Mbps	2	1	2412	11.04	11.49	7.08	8.04	0.50	Pass
11b	1Mbps	2	6	2437	11.19	11.49	7.06	7.08	0.50	Pass
11b	1Mbps	2	11	2462	11.49	11.19	7.06	<b>7.04</b>	0.50	Pass
11g	6Mbps	2	1	2412	16.88	17.08	16.32	15.70	0.50	Pass
11g	6Mbps	2	6	2437	17.18	16.93	15.70	16.34	0.50	Pass
11g	6Mbps	2	11	2462	17.03	16.73	16.32	16.32	0.50	Pass
VHT20	MCS0	2	1	2412	17.98	18.08	17.38	17.56	0.50	Pass
VHT20	MCS0	2	6	2437	<b>18.23</b>	17.98	16.92	17.60	0.50	Pass
VHT20	MCS0	2	11	2462	18.08	17.73	17.56	17.56	0.50	Pass



**Note:** The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

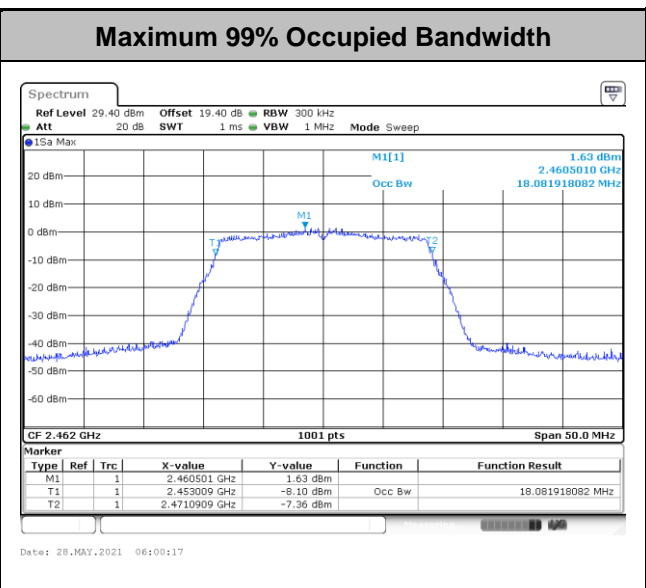
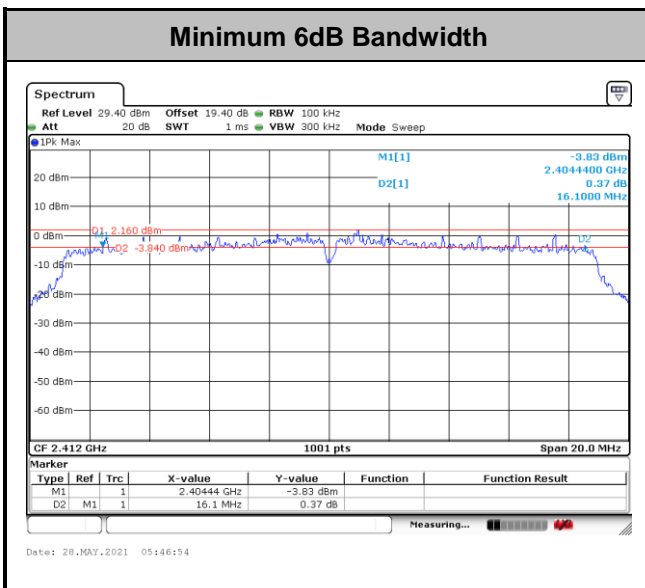




<TXBF Mode>

Test Engineer :	Hank Hsu	Temperature :	21~25°C
		Relative Humidity :	51~54%

2.4GHz Band MIMO										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)		6dB BW (MHz)		6dB BW Limit (MHz)	Pass/Fail
					Ant1	Ant2	Ant1	Ant2		
VHT20	MCS0	2	1	2412	17.98	18.08	16.10	16.94	0.50	Pass
VHT20	MCS0	2	6	2437	18.03	17.98	16.96	17.68	0.50	Pass
VHT20	MCS0	2	11	2462	18.08	17.73	16.70	16.90	0.50	Pass



**Note:** The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

## 3.2 Output Power Measurement

### 3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5 MHz, the limit for output power is 30 dBm. If transmitting antenna with directional gain greater than 6 dBi is used, the output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

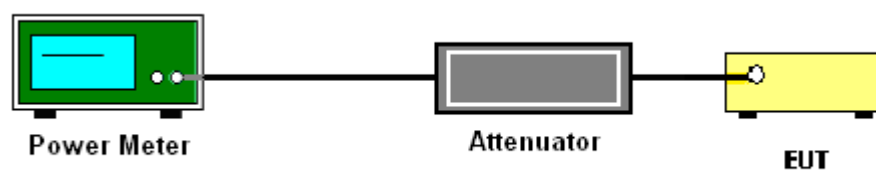
### 3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

### 3.2.3 Test Procedures

1. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Measure the conducted output power and record the results in the test report.
5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

### 3.2.4 Test Setup





3.2.5 Test Result of Average Output Power

<CDD Mode>

Test Engineer :	Hank Hsu and Ching Chen	Temperature :	21~25°C
		Relative Humidity :	51~54%

2.4GHz Band MIMO																
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant1	Ant2	SUM	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	
11b	1Mbps	2	1	2412	18.60	18.40	21.51	30.00	3.10	24.61	36.00	Pass				
11b	1Mbps	2	6	2437	19.80	18.50	22.21	30.00	3.10	25.31	36.00	Pass				
11b	1Mbps	2	11	2462	18.20	18.10	21.16	30.00	3.10	24.26	36.00	Pass				
11g	6Mbps	2	1	2412	14.80	15.30	18.07	30.00	3.10	21.17	36.00	Pass				
11g	6Mbps	2	6	2437	17.90	16.90	20.44	30.00	3.10	23.54	36.00	Pass				
11g	6Mbps	2	11	2462	13.50	13.80	16.66	30.00	3.10	19.76	36.00	Pass				
HT20	MCS0	2	1	2412	15.30	16.00	18.67	30.00	3.10	21.77	36.00	Pass				
HT20	MCS0	2	6	2437	18.90	17.70	21.35	30.00	3.10	24.45	36.00	Pass				
HT20	MCS0	2	11	2462	11.00	11.90	14.48	30.00	3.10	17.58	36.00	Pass				
VHT20	MCS0	2	1	2412	15.40	16.10	18.77	30.00	3.10	21.87	36.00	Pass				
VHT20	MCS0	2	6	2437	19.00	17.80	21.45	30.00	3.10	24.55	36.00	Pass				
VHT20	MCS0	2	11	2462	11.10	12.00	14.58	30.00	3.10	17.68	36.00	Pass				

Note: Measured power (dBm) has offset with cable loss.



<802.11ax Mode>

2.4GHz Band MIMO																	
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	Average Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
						Ant1	Ant2	SUM	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	
HE20	MCS0	2	1	2412	Full	15.20	15.70	18.47	30.00		3.10		21.57		36.00		Pass
HE20	MCS0	2	1	2412	26/0	6.80	7.80	10.34	30.00		3.10		13.44		36.00		Pass
HE20	MCS0	2	1	2412	52/37	9.00	11.10	13.19	30.00		3.10		16.29		36.00		Pass
HE20	MCS0	2	1	2412	106/53	13.00	13.50	16.27	30.00		3.10		19.37		36.00		Pass
HE20	MCS0	2	6	2437	Full	18.80	17.70	21.30	30.00		3.10		24.40		36.00		Pass
HE20	MCS0	2	6	2437	26/4	9.40	7.70	11.64	30.00		3.10		14.74		36.00		Pass
HE20	MCS0	2	6	2437	52/39	13.60	11.40	15.65	30.00		3.10		18.75		36.00		Pass
HE20	MCS0	2	6	2437	106/53	16.00	14.60	18.37	30.00		3.10		21.47		36.00		Pass
HE20	MCS0	2	11	2462	Full	10.90	11.90	14.44	30.00		3.10		17.54		36.00		Pass
HE20	MCS0	2	11	2462	26/8	3.70	2.80	6.28	30.00		3.10		9.38		36.00		Pass
HE20	MCS0	2	11	2462	52/40	6.50	6.40	9.46	30.00		3.10		12.56		36.00		Pass
HE20	MCS0	2	11	2462	106/54	8.00	9.40	11.77	30.00		3.10		14.87		36.00		Pass

Note: Measured power (dBm) has offset with cable loss.



<TXBF Modes>

Test Engineer :	Hank Hsu	Temperature :	21~25°C
		Relative Humidity :	51~54%

2.4GHz Band MIMO																
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant1	Ant2	SUM	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	
VHT20	MCS0	2	1	2412	14.50	12.50	16.62	29.89	29.89	6.11	6.11	22.73	22.73	36.00	36.00	Pass
VHT20	MCS0	2	6	2437	17.40	17.20	20.31	29.89	29.89	6.11	6.11	26.42	26.42	36.00	36.00	Pass
VHT20	MCS0	2	11	2462	10.30	8.90	12.67	29.89	29.89	6.11	6.11	18.78	18.78	36.00	36.00	Pass

Note: Measured power (dBm) has offset with cable loss.

### 3.3 Power Spectral Density Measurement

#### 3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band at any time interval of continuous transmission.

#### 3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

#### 3.3.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.10.2 Method PKPSD.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

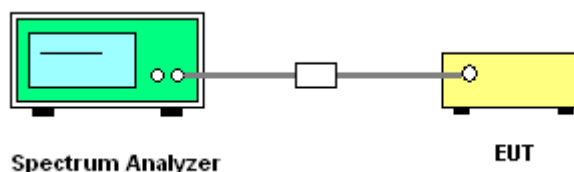
If measurements performed using method (2) plus  $10 \log(N)$  exceeds the emission limit, the test should choose method (1) before declaring that the device fails the emission limit.

Method (1): Measure and sum the spectra across the outputs.

The total final Power Spectral Density is from a device with 2 transmitter outputs. The spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 to obtain the value for the first frequency bin of the summed spectrum.

Method (2): Measure and add  $10 \log(N)$  dB, where N is the number of outputs. (N=2)

#### 3.3.4 Test Setup





3.3.5 Test Result of Power Spectral Density

<CDD Mode>

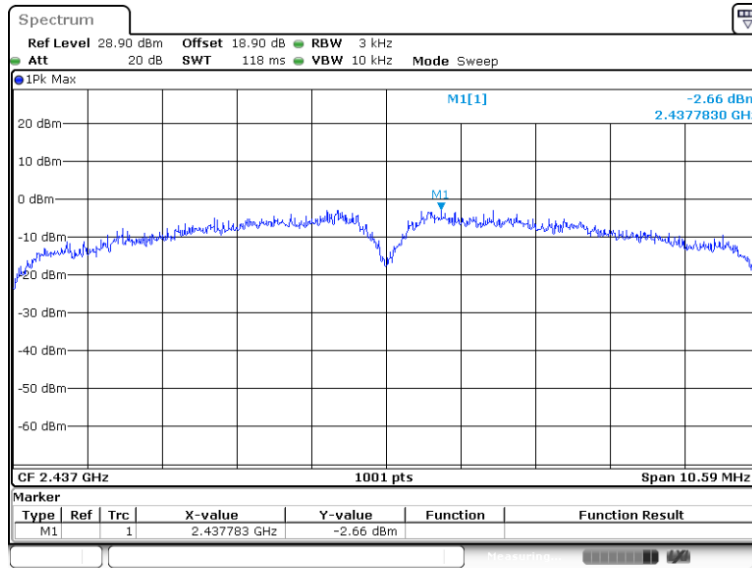
Test Engineer :	Hank Hsu and Ching Chen	Temperature :	21~25°C
		Relative Humidity :	51~54%

2.4GHz Band MIMO												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm/3kHz)			DG (dBi)		Peak PSD Limit (dBm/3kHz)		Pass/Fail
					Ant1	Ant2	Worse + 3.01	Ant1	Ant2	Ant1	Ant2	
11b	1Mbps	2	1	2412	-3.37	-3.69	-0.36	6.11	7.89	Pass		
11b	1Mbps	2	6	2437	-2.66	-4.05	<b>0.35</b>	6.11	7.89	Pass		
11b	1Mbps	2	11	2462	-3.38	-3.91	-0.37	6.11	7.89	Pass		
11g	6Mbps	2	1	2412	-9.18	-10.04	-6.17	6.11	7.89	Pass		
11g	6Mbps	2	6	2437	-6.51	-8.73	-3.50	6.11	7.89	Pass		
11g	6Mbps	2	11	2462	-10.51	-10.51	-7.50	6.11	7.89	Pass		
VHT20	MCS0	2	1	2412	-8.92	-8.77	-5.76	6.11	7.89	Pass		
VHT20	MCS0	2	6	2437	-5.74	-7.67	-2.73	6.11	7.89	Pass		
VHT20	MCS0	2	11	2462	-13.66	-12.96	-9.95	6.11	7.89	Pass		

Note: Measured power density (dBm) has offset with cable loss.

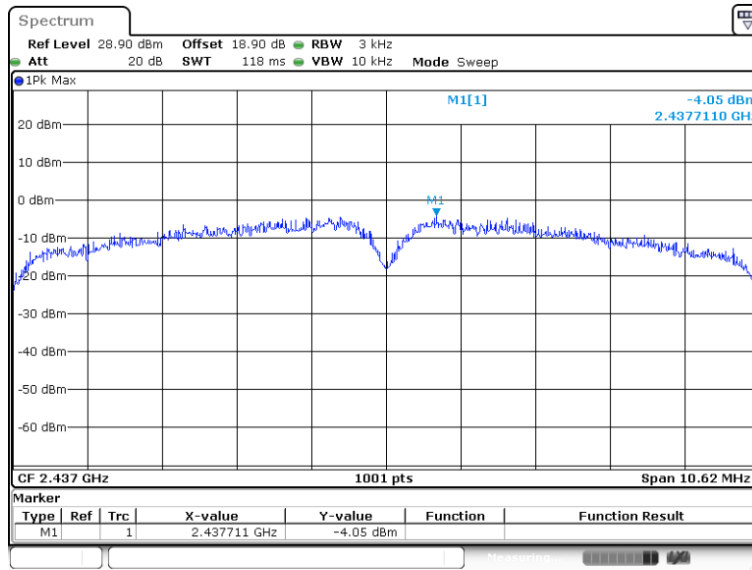


Worst Case Power Density (dBm/3kHz) for MIMO Ant. 1



Date: 20.MAY.2021 06:13:44

Worst Case Power Density (dBm/3kHz) for MIMO Ant. 2



Date: 20.MAY.2021 06:15:37





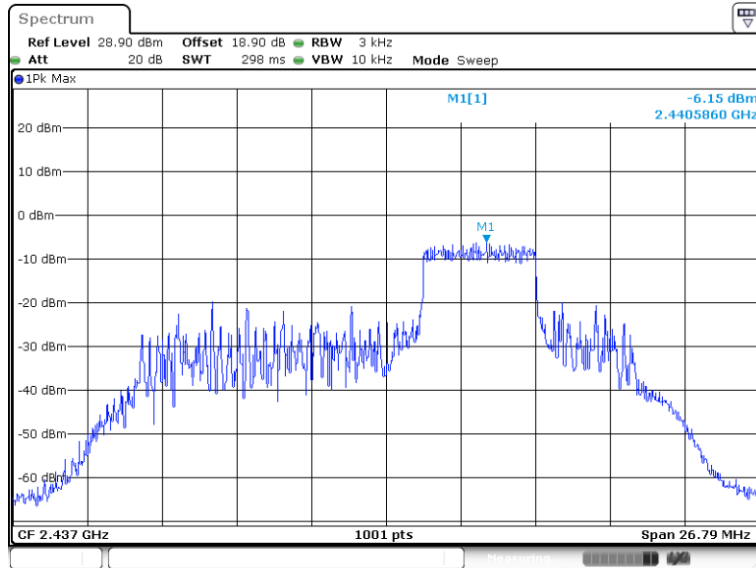
<802.11ax Mode>

2.4GHz Band MIMO													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	Peak PSD (dBm/3kHz)			DG (dBi)		Peak PSD Limit (dBm/3kHz)		Pass/Fail
						Ant1	Ant2	Worse + 3.01	Ant1	Ant2	Ant1	Ant2	
HE20	MCS0	2	1	2412	Full	-9.55	-8.94	-5.93	6.11		7.89		Pass
HE20	MCS0	2	1	2412	26/0	-9.14	-10.11	-6.13	6.11		7.89		Pass
HE20	MCS0	2	1	2412	52/37	-10.51	-8.30	-5.29	6.11		7.89		Pass
HE20	MCS0	2	1	2412	106/53	-10.45	-9.55	-6.54	6.11		7.89		Pass
HE20	MCS0	2	6	2437	Full	-6.18	-7.94	-3.17	6.11		7.89		Pass
HE20	MCS0	2	6	2437	26/4	-6.80	-8.55	-3.79	6.11		7.89		Pass
HE20	MCS0	2	6	2437	52/39	-6.47	-8.27	-3.46	6.11		7.89		Pass
HE20	MCS0	2	6	2437	106/53	-6.15	-7.31	-3.14	6.11		7.89		Pass
HE20	MCS0	2	11	2462	Full	-13.82	-13.36	-10.35	6.11		7.89		Pass
HE20	MCS0	2	11	2462	26/8	-14.24	-14.15	-11.14	6.11		7.89		Pass
HE20	MCS0	2	11	2462	52/40	-13.85	-13.79	-10.78	6.11		7.89		Pass
HE20	MCS0	2	11	2462	106/54	-14.62	-13.49	-10.48	6.11		7.89		Pass

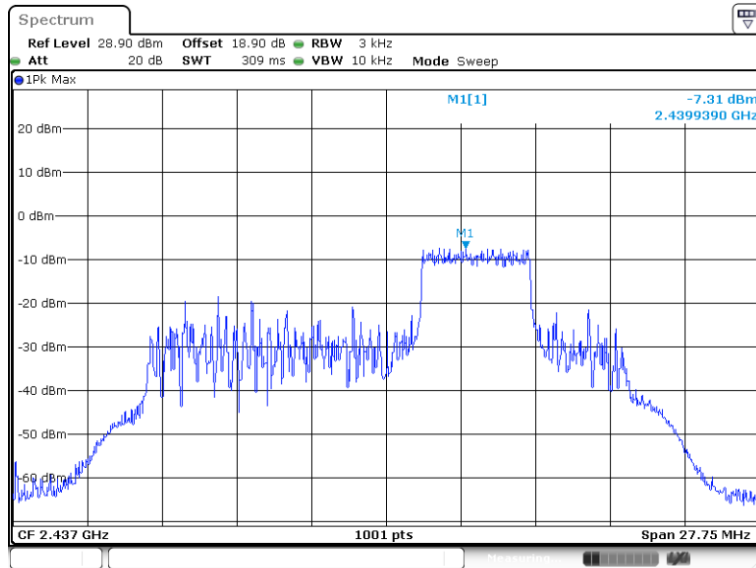
Note: Measured power density (dBm) has offset with cable loss.



Worst Case Power Density (dBm/3kHz) for MIMO Ant. 1



Worst Case Power Density (dBm/3kHz) for MIMO Ant. 2





<TXBF Mode>

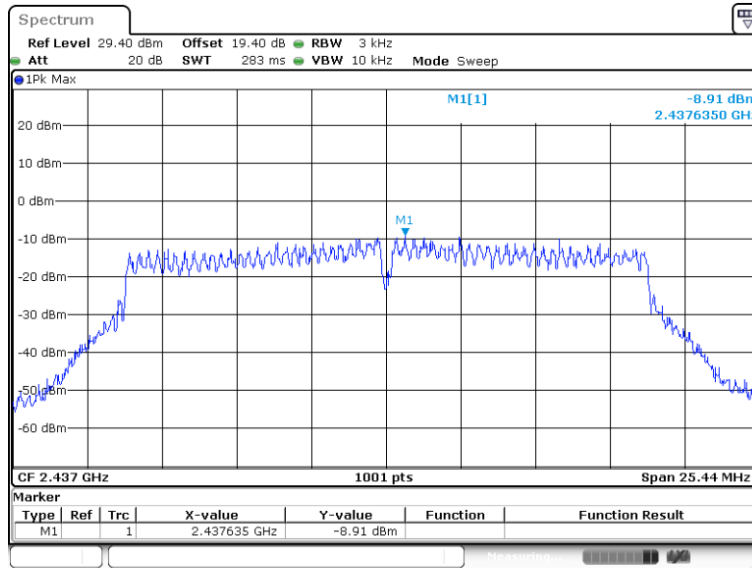
Test Engineer :	Hank Hsu	Temperature :	21~25°C
		Relative Humidity :	51~54%

2.4GHz Band MIMO												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm/3kHz)			DG (dBi)		Peak PSD Limit (dBm/3kHz)		Pass/Fail
					Ant1	Ant2	Worse + 3.01	Ant1	Ant2	Ant1	Ant2	
VHT20	MCS0	2	1	2412	-12.09	-13.31	-9.08	6.11		7.89		Pass
VHT20	MCS0	2	6	2437	-8.91	-8.88	<b>-5.87</b>	6.11		7.89		Pass
VHT20	MCS0	2	11	2462	-15.40	-16.08	-12.39	6.11		7.89		Pass

Note: Measured power density (dBm) has offset with cable loss.

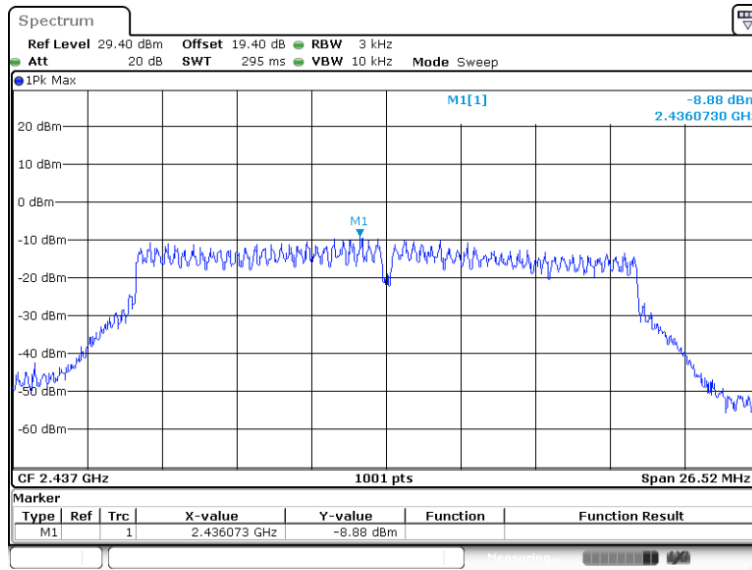


Worst Case Power Density (dBm/3kHz) for MIMO Ant. 1



Date: 28.MAY.2021 05:54:01

Worst Case Power Density (dBm/3kHz) for MIMO Ant. 2



Date: 28.MAY.2021 05:55:48

## 3.4 Conducted Band Edges and Spurious Emission Measurement

### 3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement.

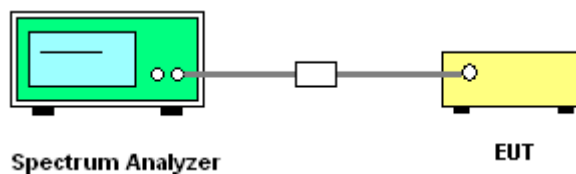
### 3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

### 3.4.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Set RBW = 100 kHz, VBW = 300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

### 3.4.4 Test Setup





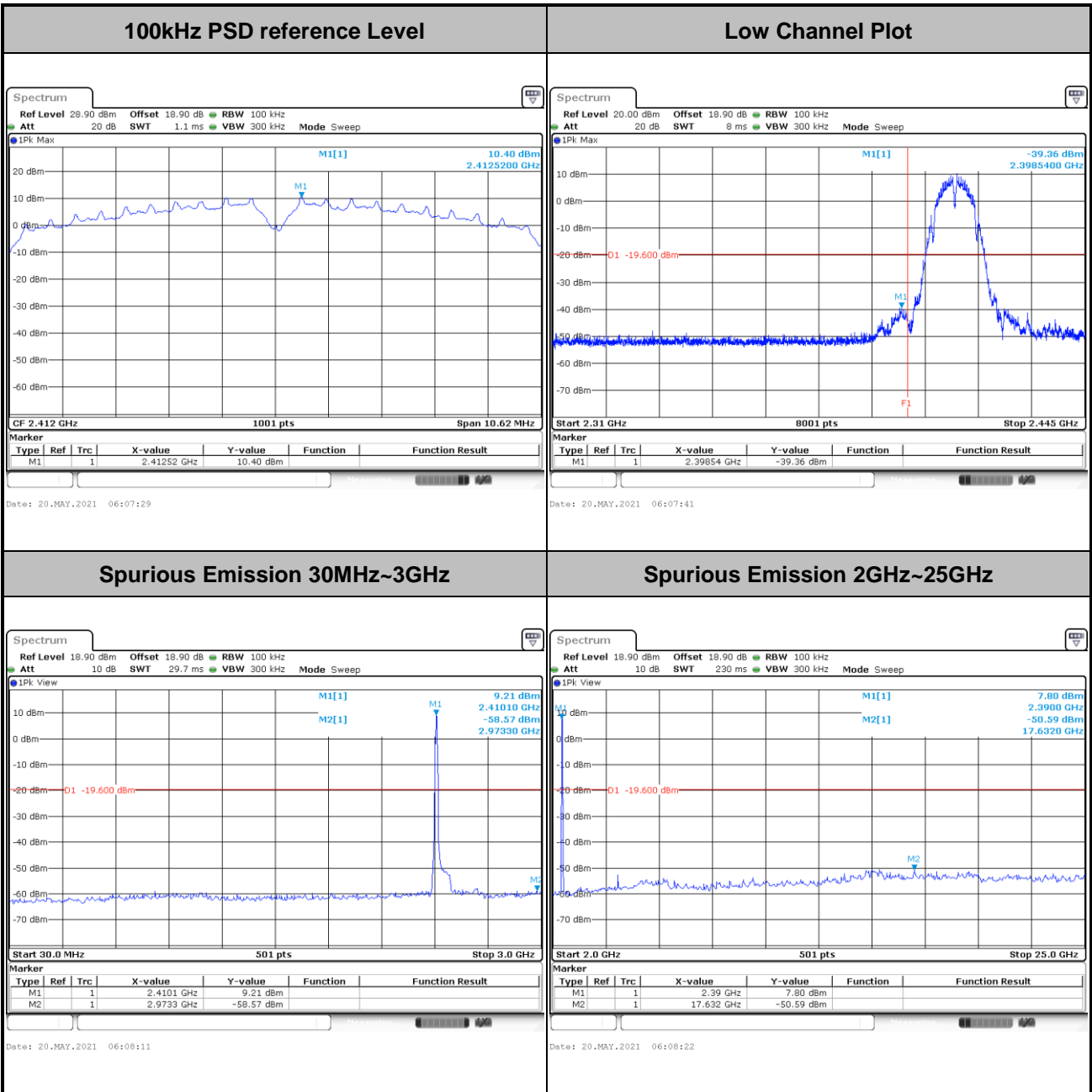
### 3.4.5 Test Result of Conducted Band Edges and Spurious Emission

<CDD Mode>

Test Engineer :	Hank Hsu and Ching Chen	Temperature :	21~25°C
		Relative Humidity :	51~54%

Number of TX = 2, Ant. 1 (Measured)

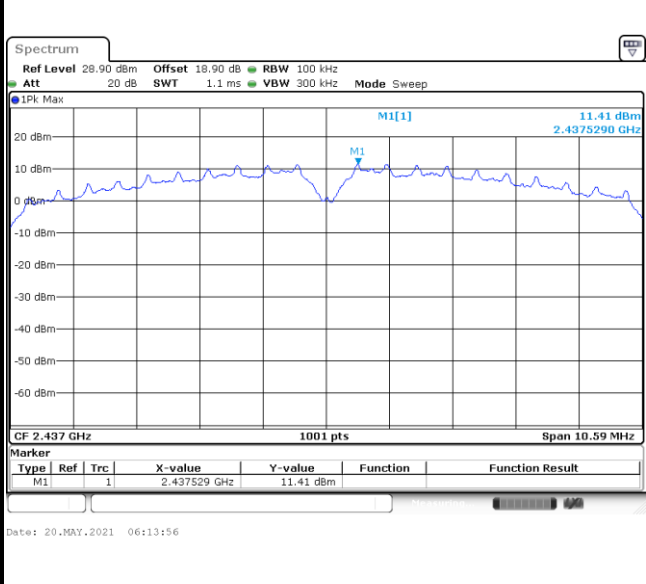
Test Mode :	802.11b	Test Channel :	01
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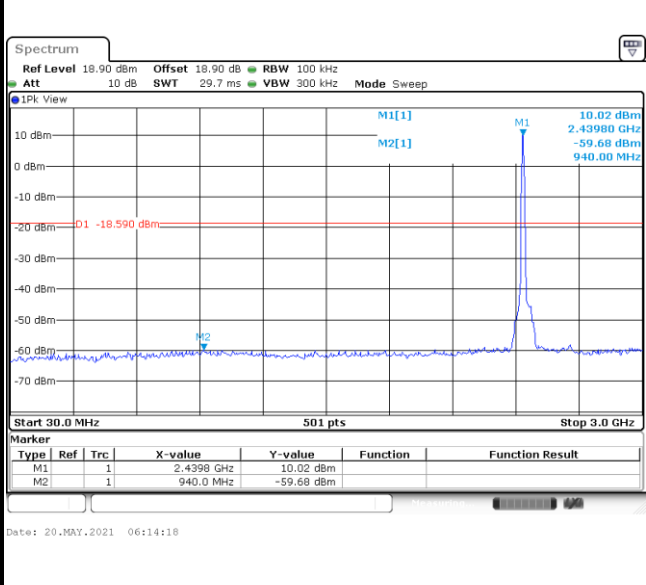


Test Mode :	802.11b	Test Channel :	06
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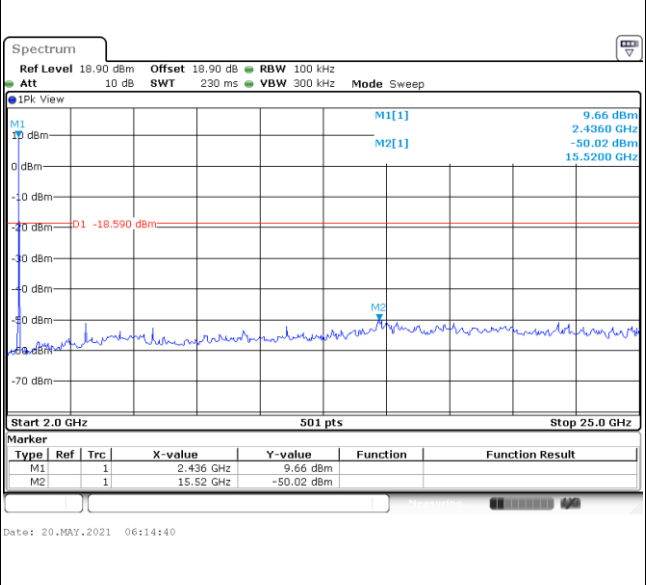
<b>100kHz PSD reference Level</b>	<b>Mid Channel Plot</b>
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**Spurious Emission 30MHz~3GHz**

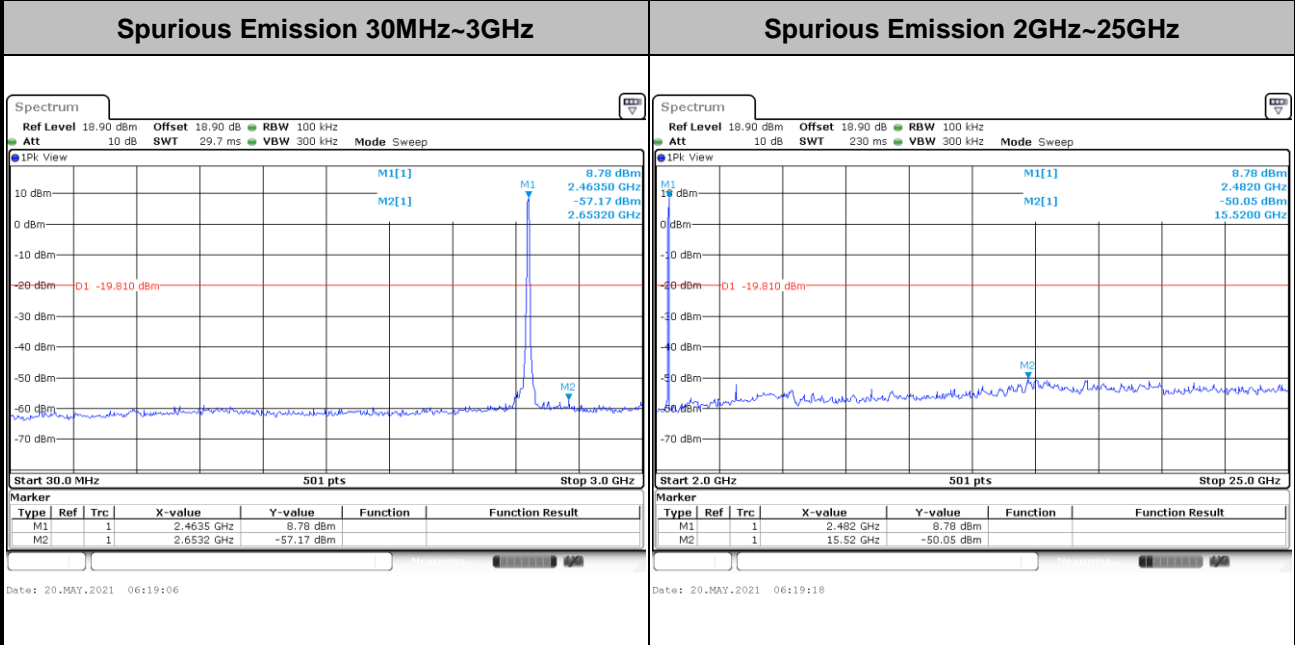
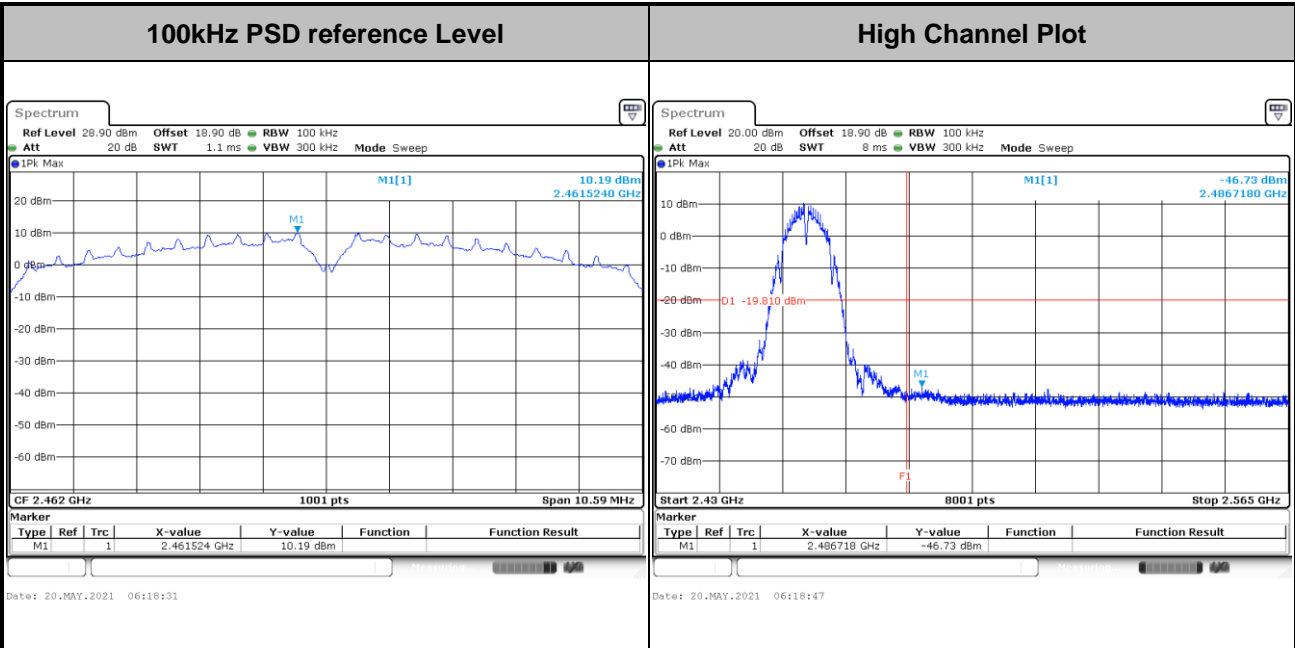


**Spurious Emission 2GHz~25GHz**





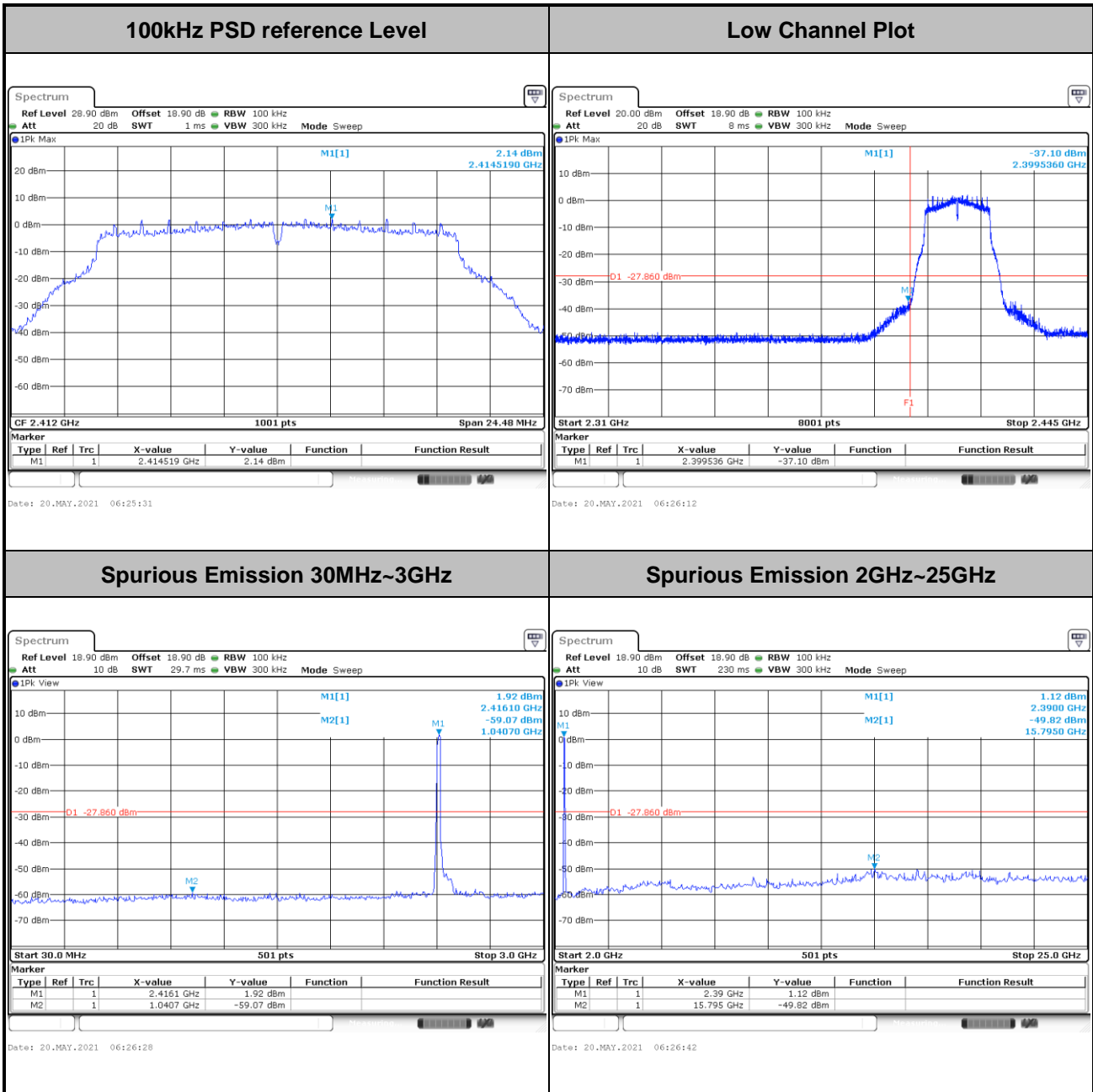
Test Mode :	802.11b	Test Channel :	11
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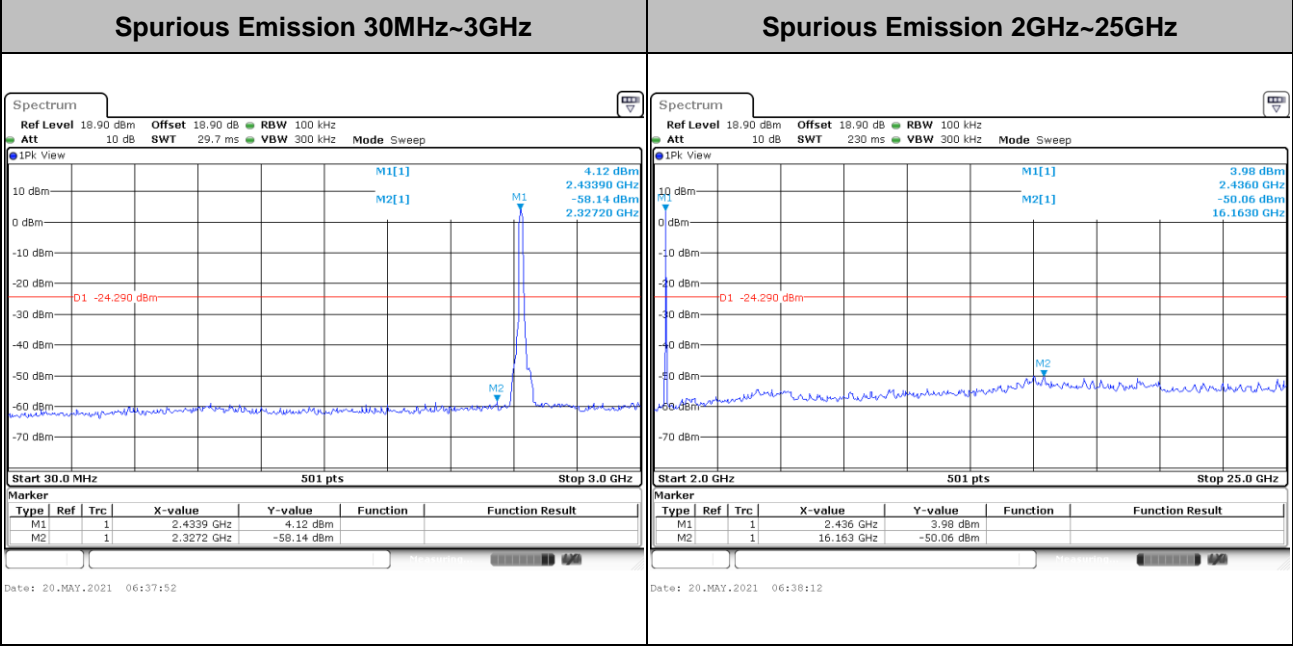
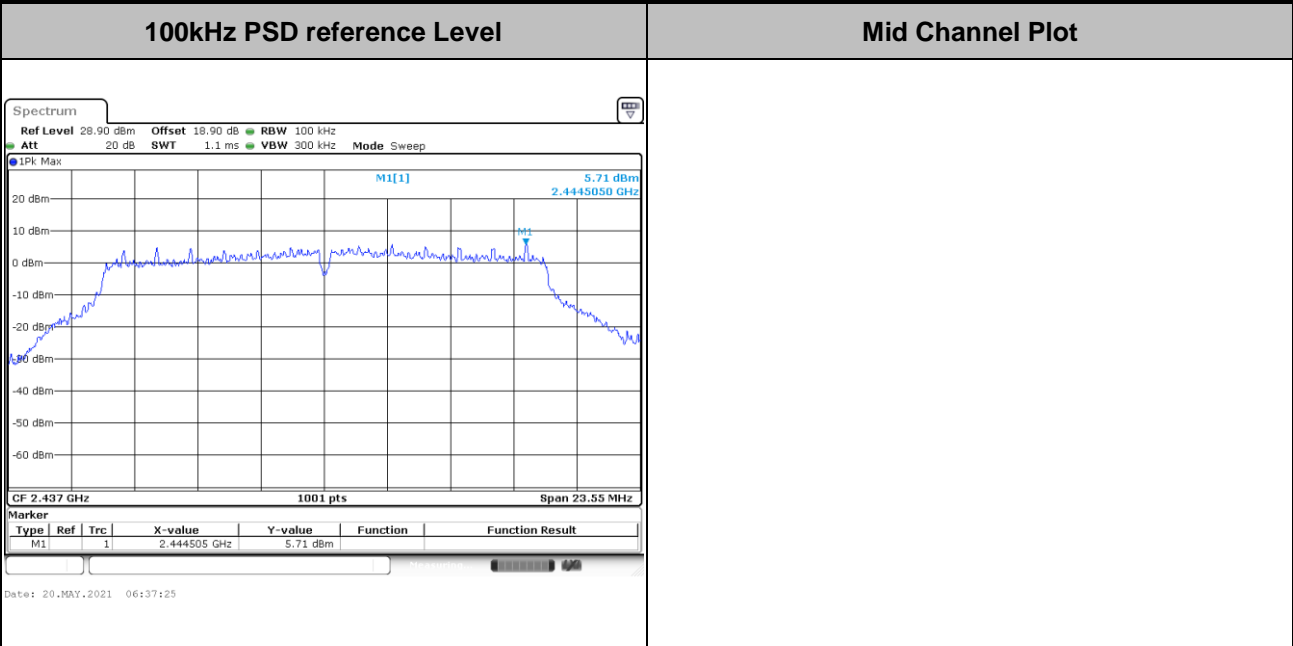


Test Mode :	802.11g	Test Channel :	01
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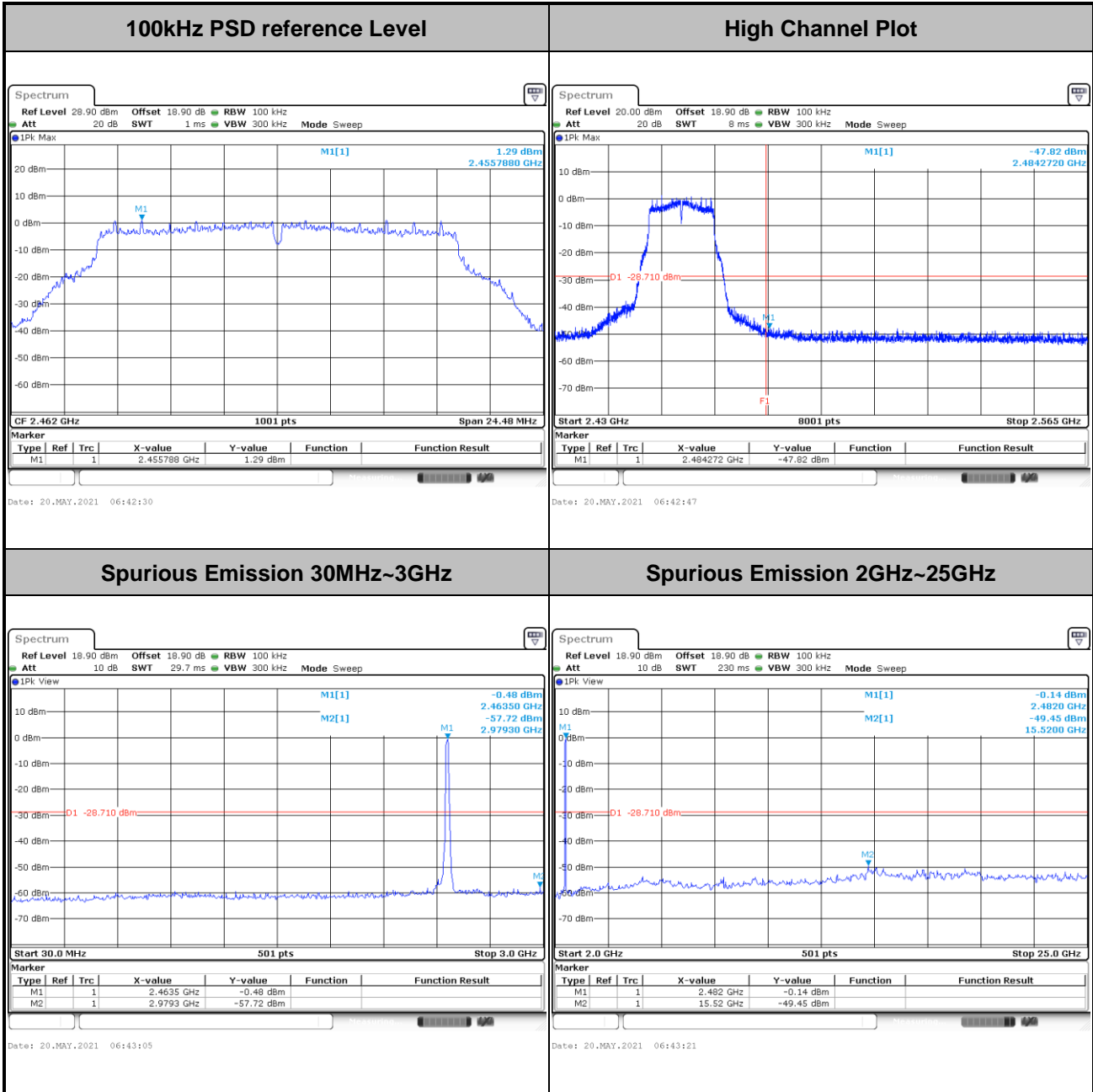


Test Mode :	802.11g	Test Channel :	06
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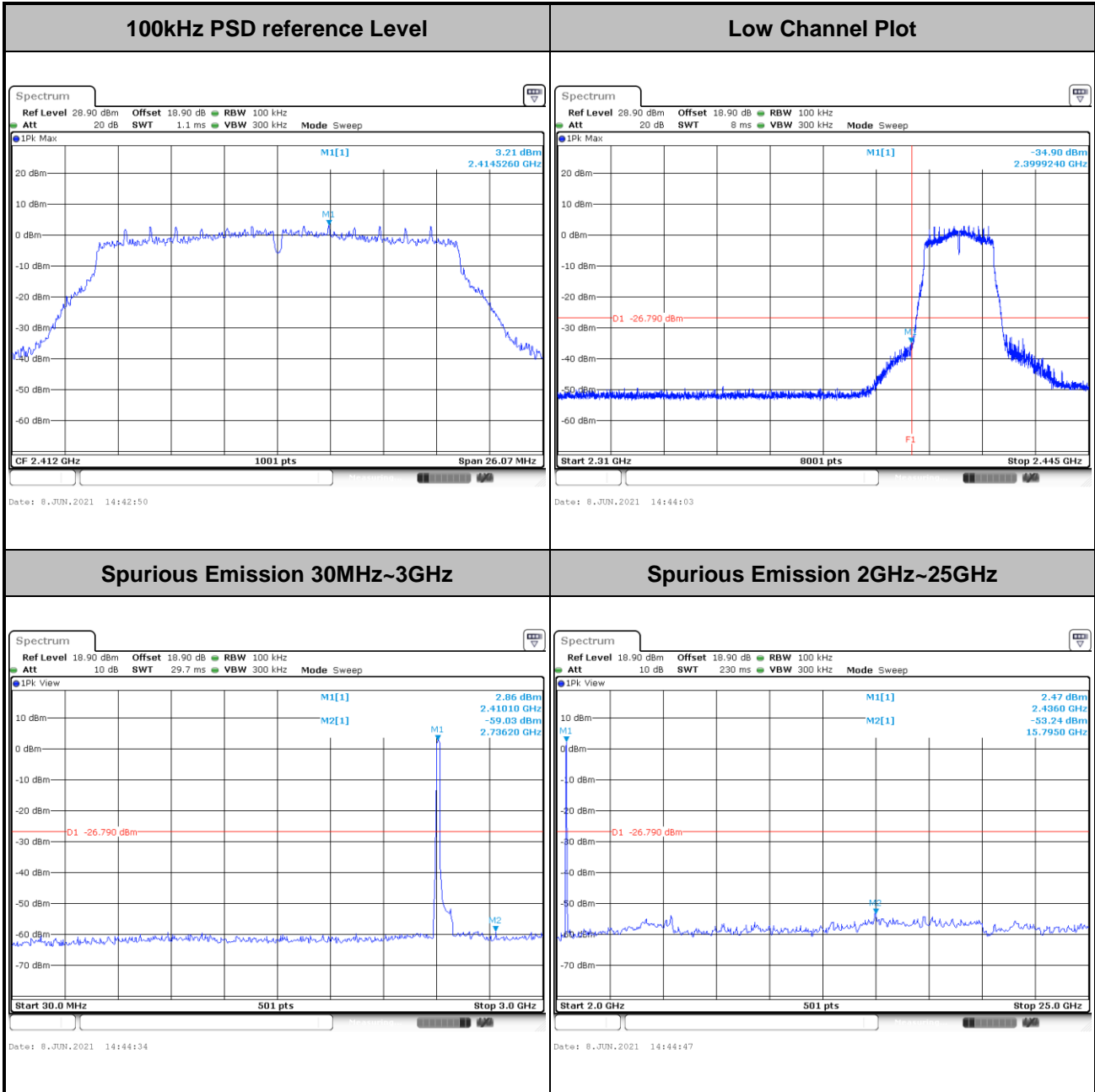


Test Mode :	802.11g	Test Channel :	11
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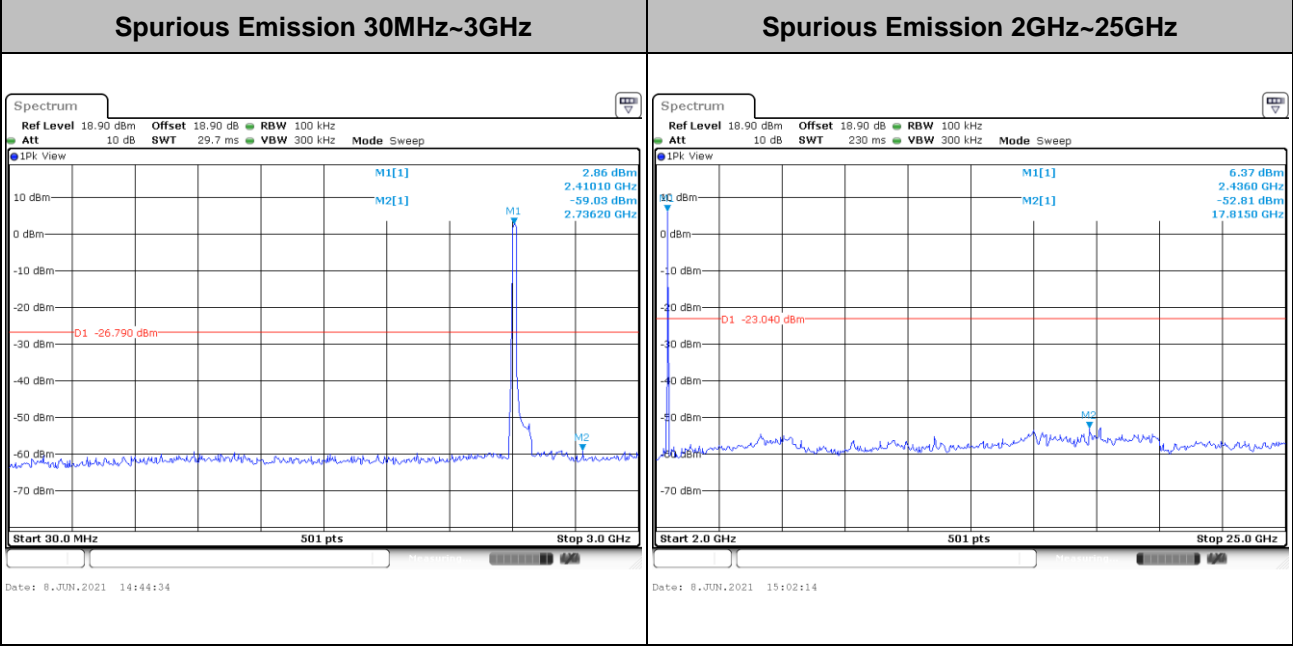
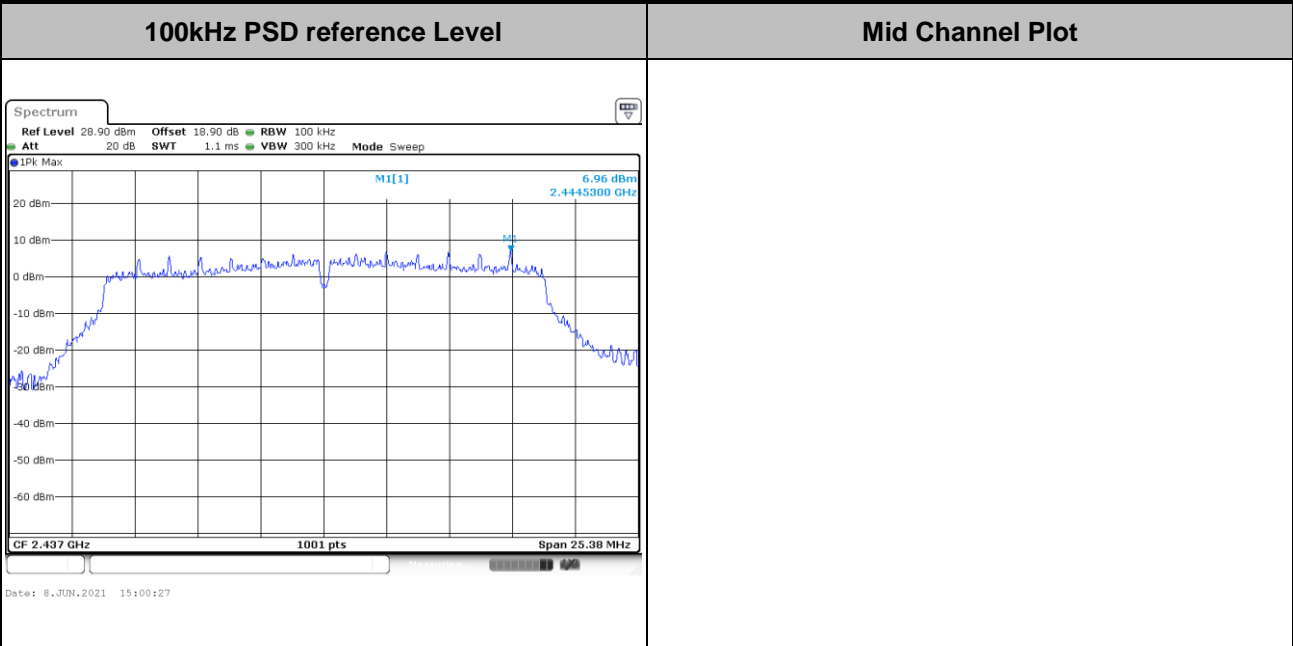


Test Mode :	802.11ac VHT20	Test Channel :	01
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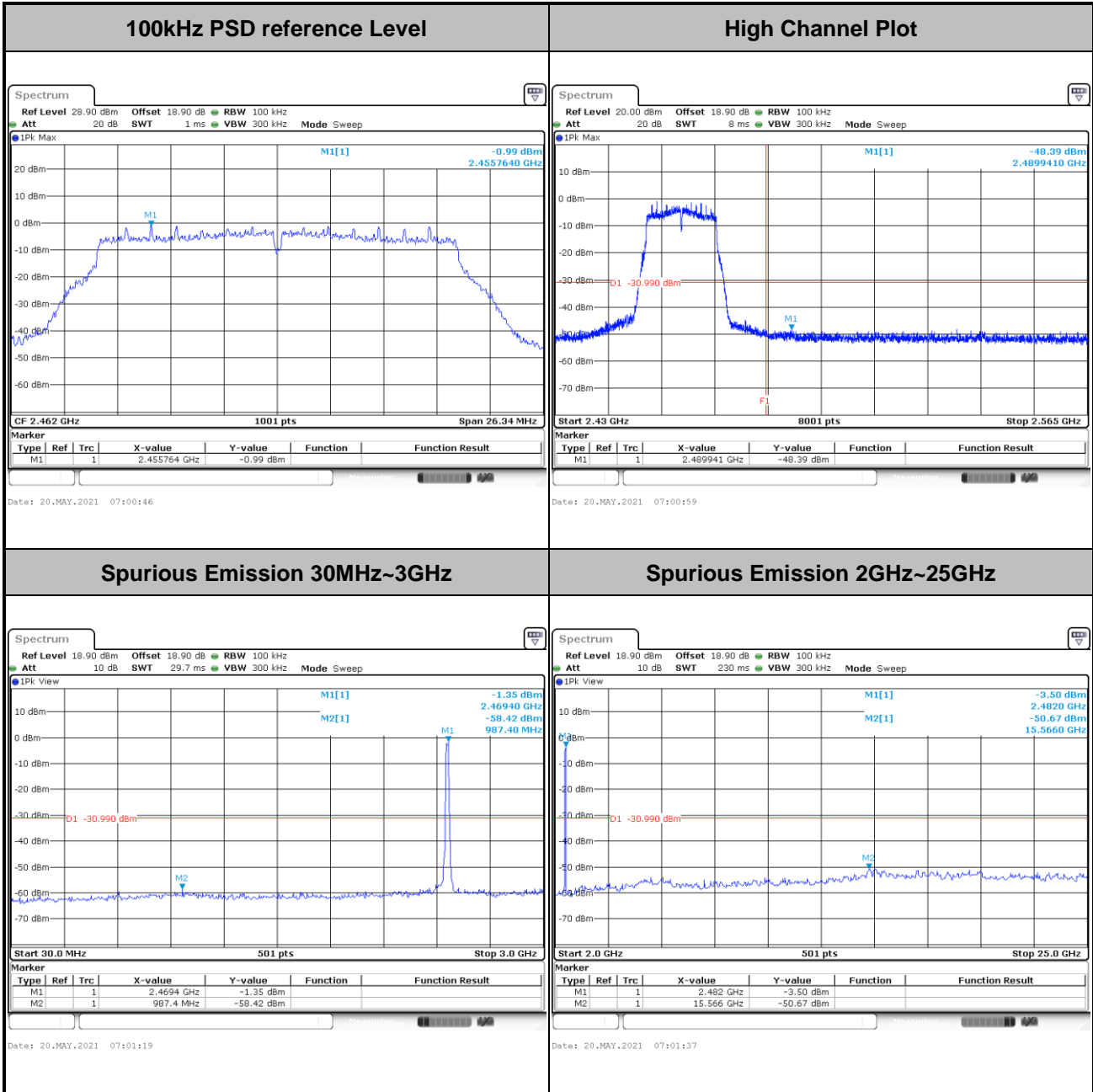


Test Mode :	802.11ac VHT20	Test Channel :	06
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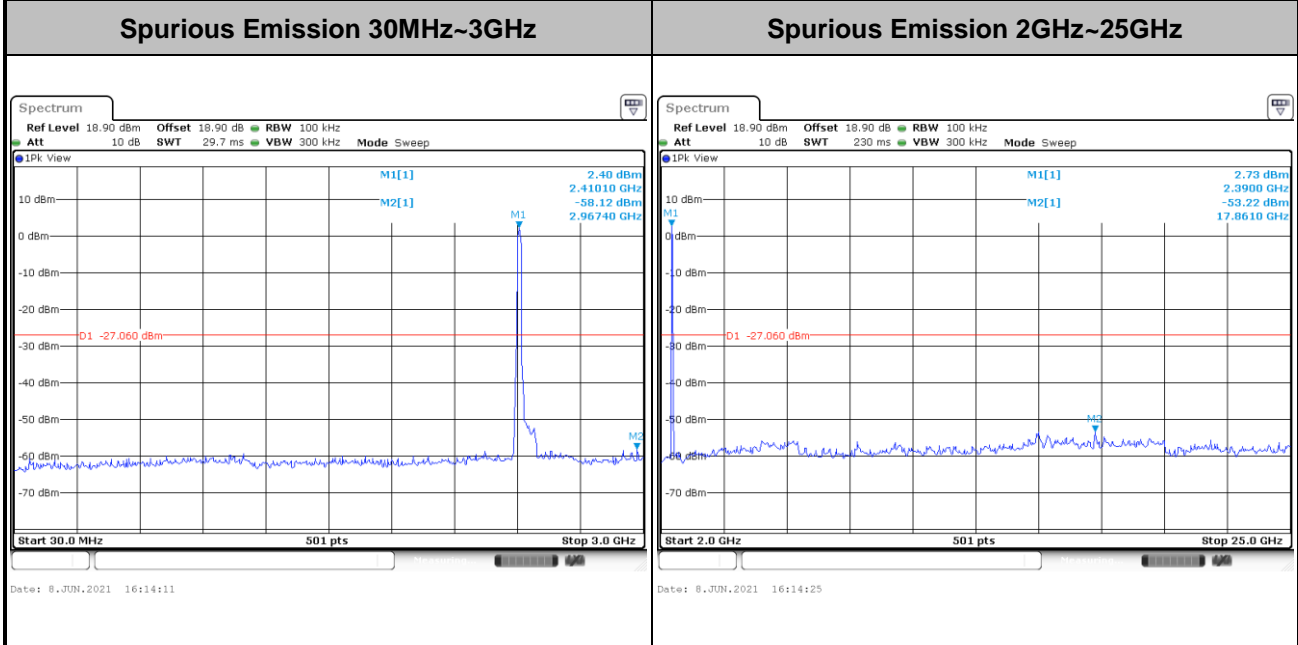
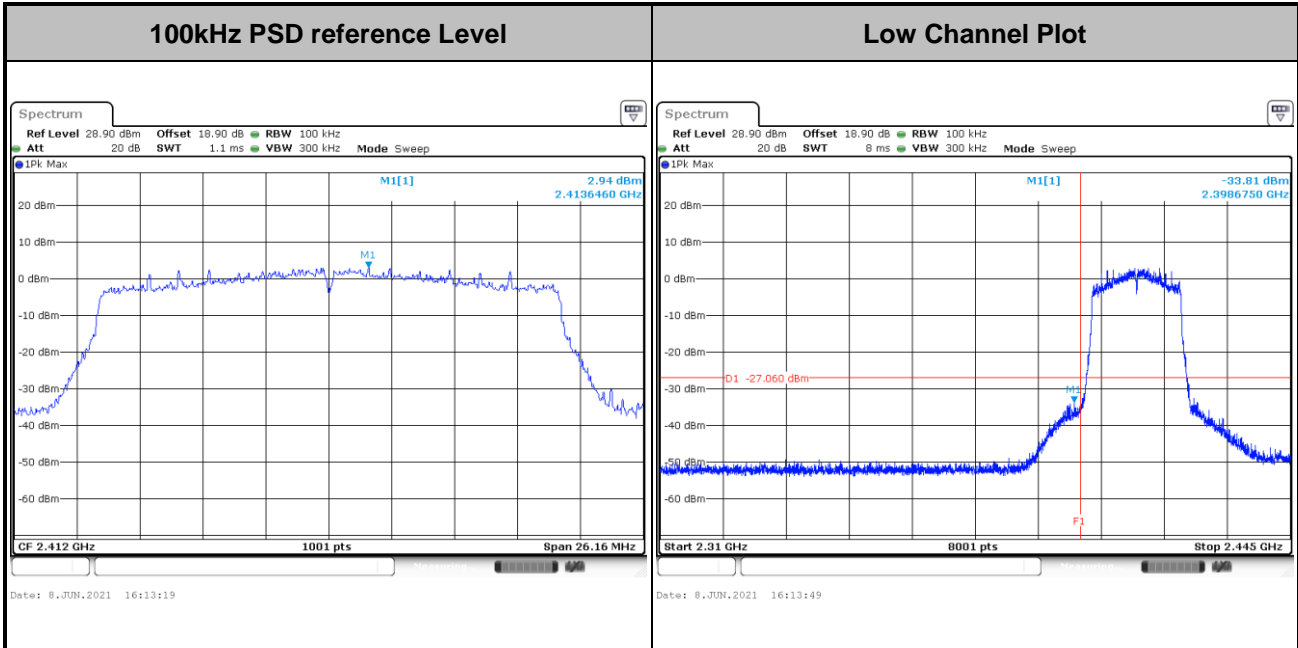


Test Mode :	802.11ac VHT20	Test Channel :	11
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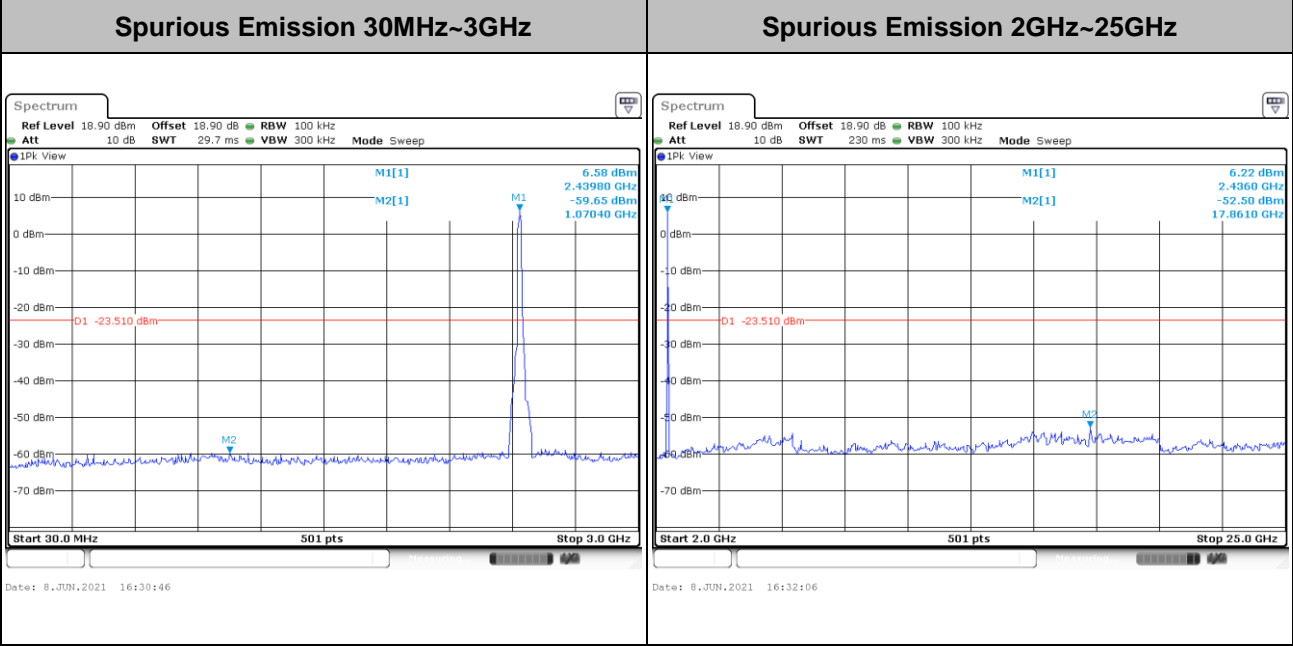
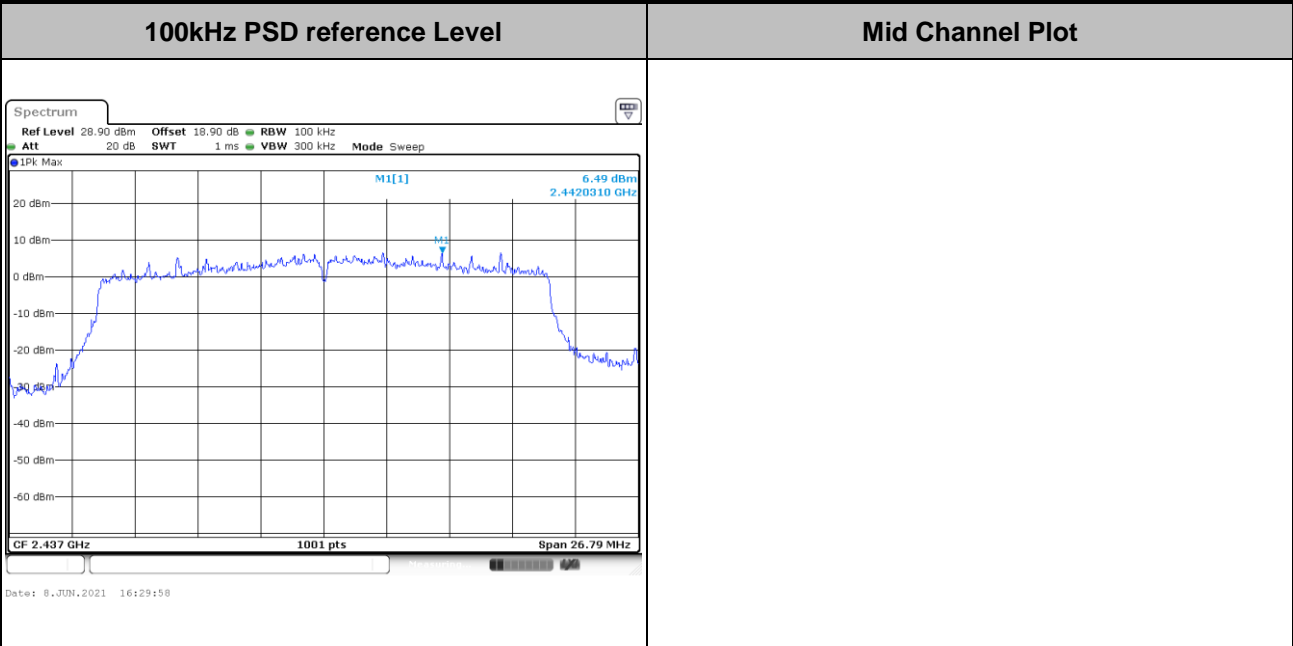


<b>Test Mode :</b>	802.11ax HE20	<b>Test Channel :</b>	01 Full RU
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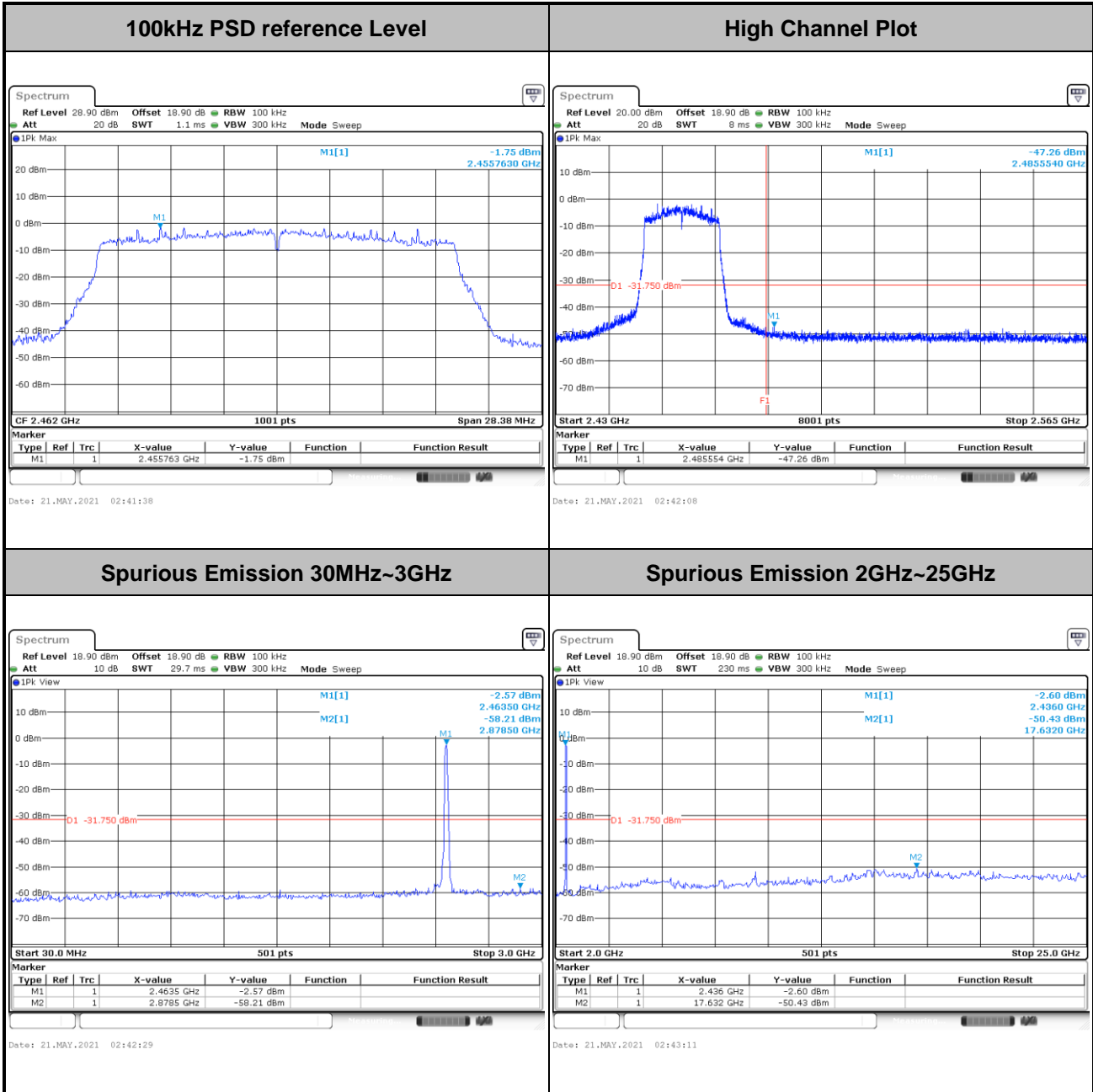
<b>Test Mode :</b>	802.11ax HE20	<b>Test Channel :</b>	06 Full RU
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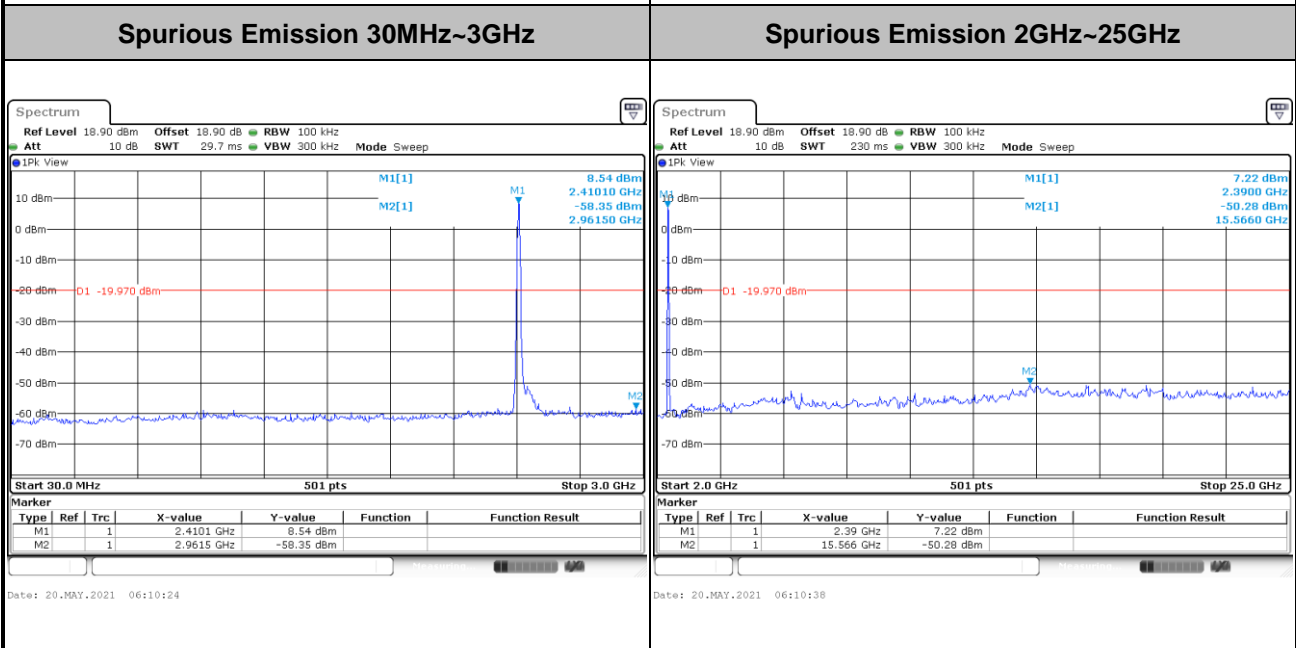
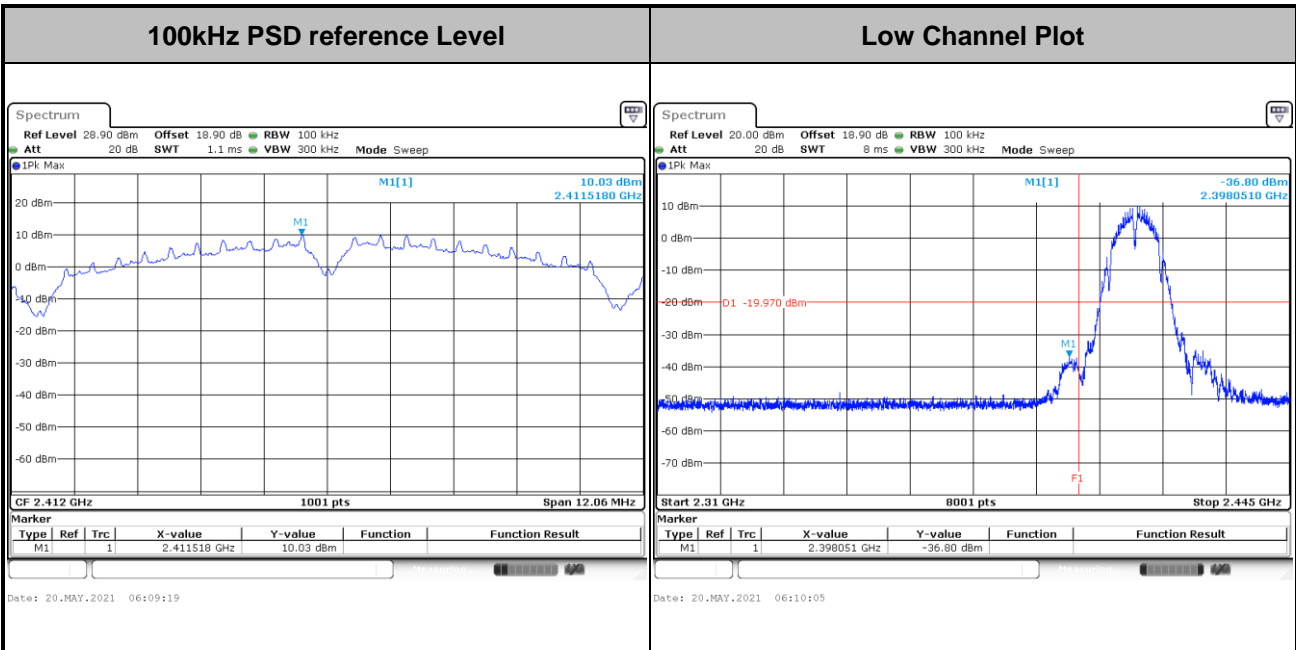
Test Mode :	802.11ax HE20	Test Channel :	11 Full RU
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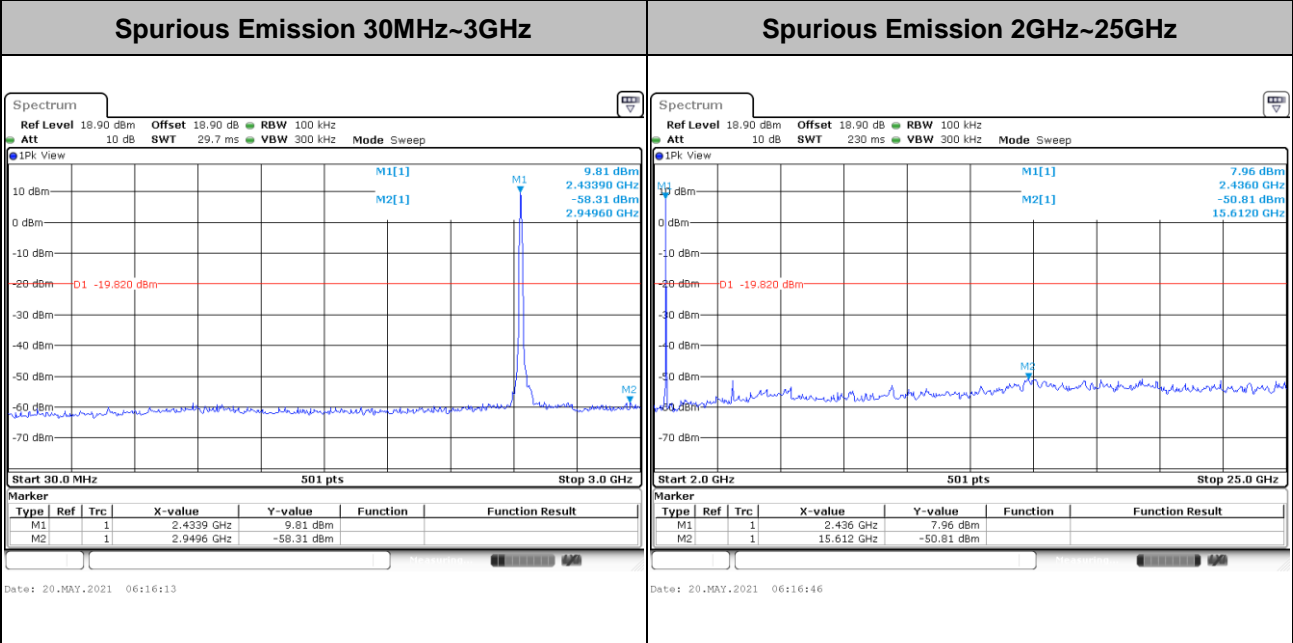
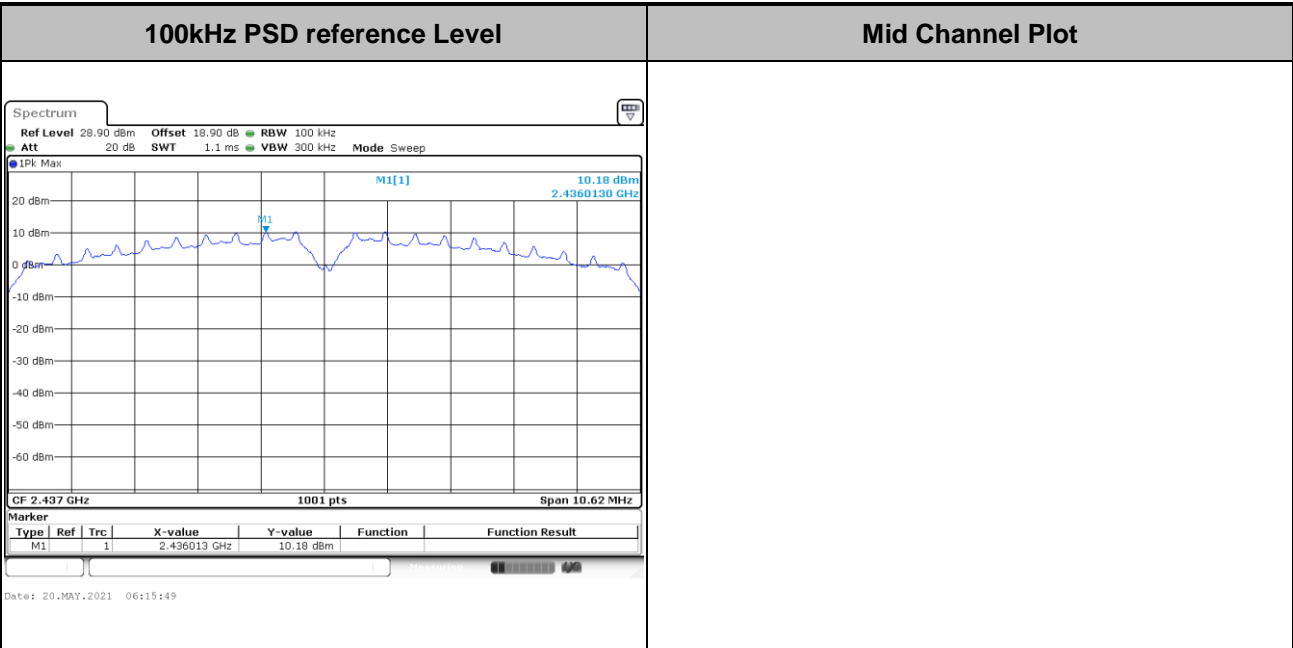
Number of TX = 2, Ant. 2 (Measured)

Test Mode :	802.11b	Test Channel :	01
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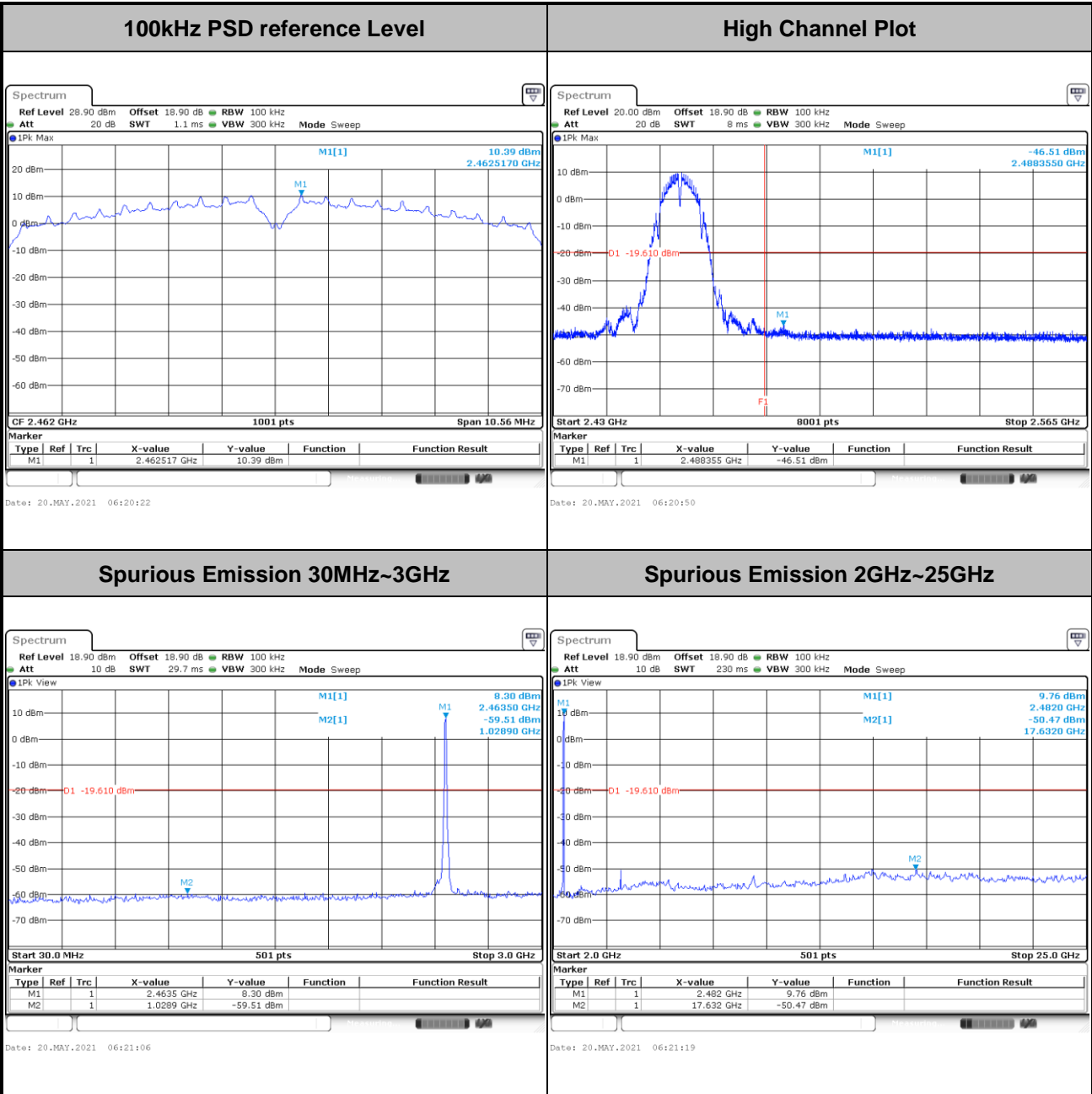


Test Mode :	802.11b	Test Channel :	06
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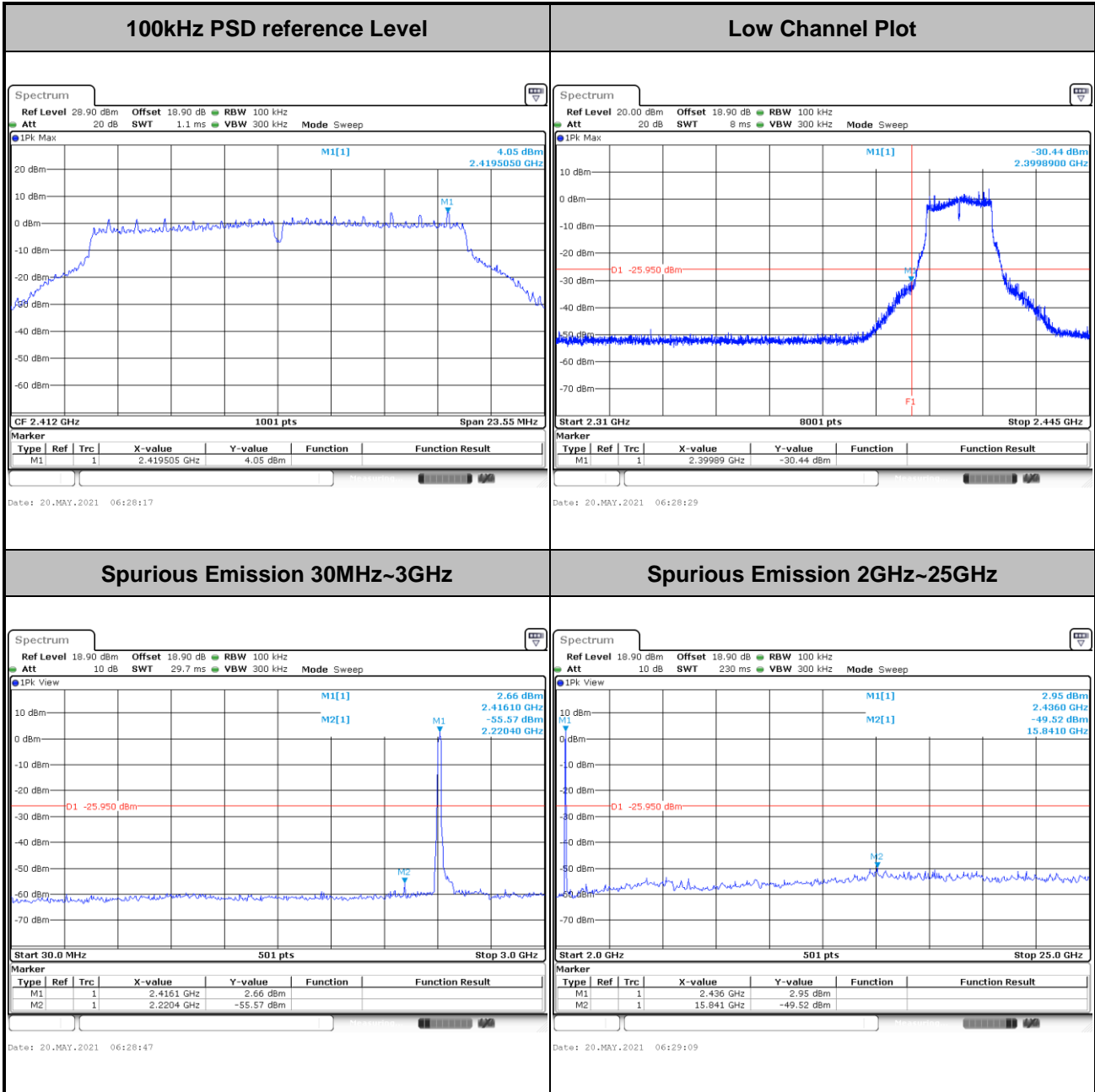


Test Mode :	802.11b	Test Channel :	11
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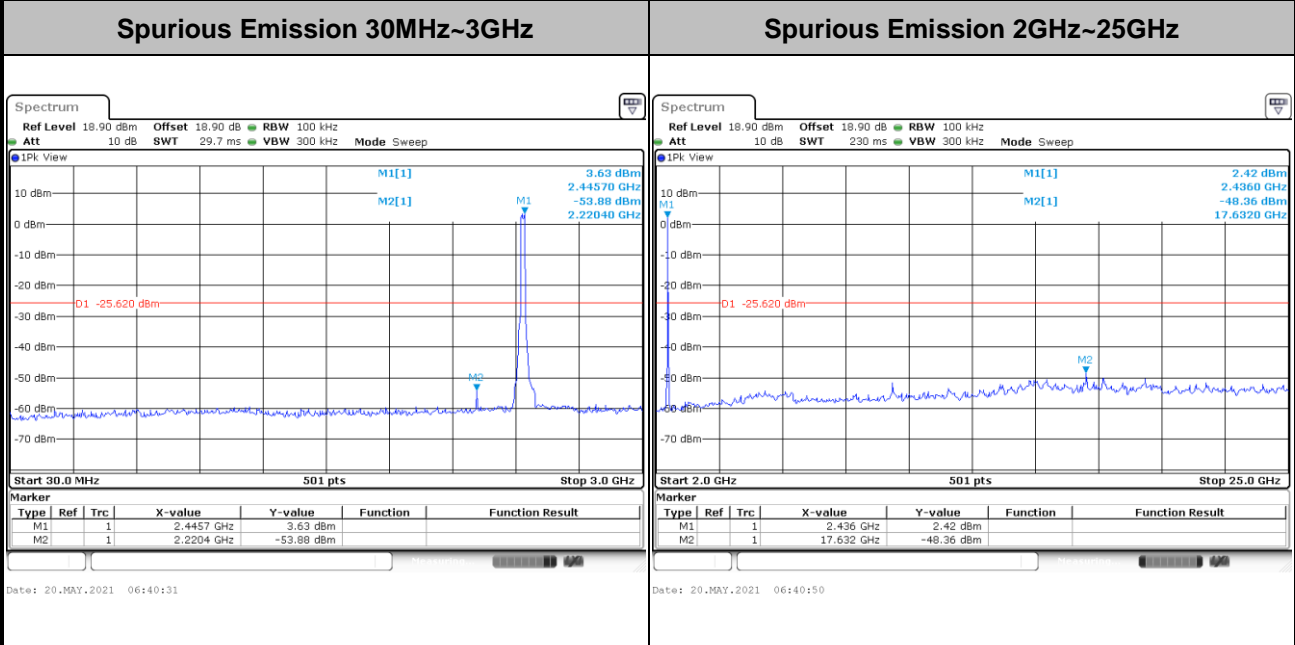
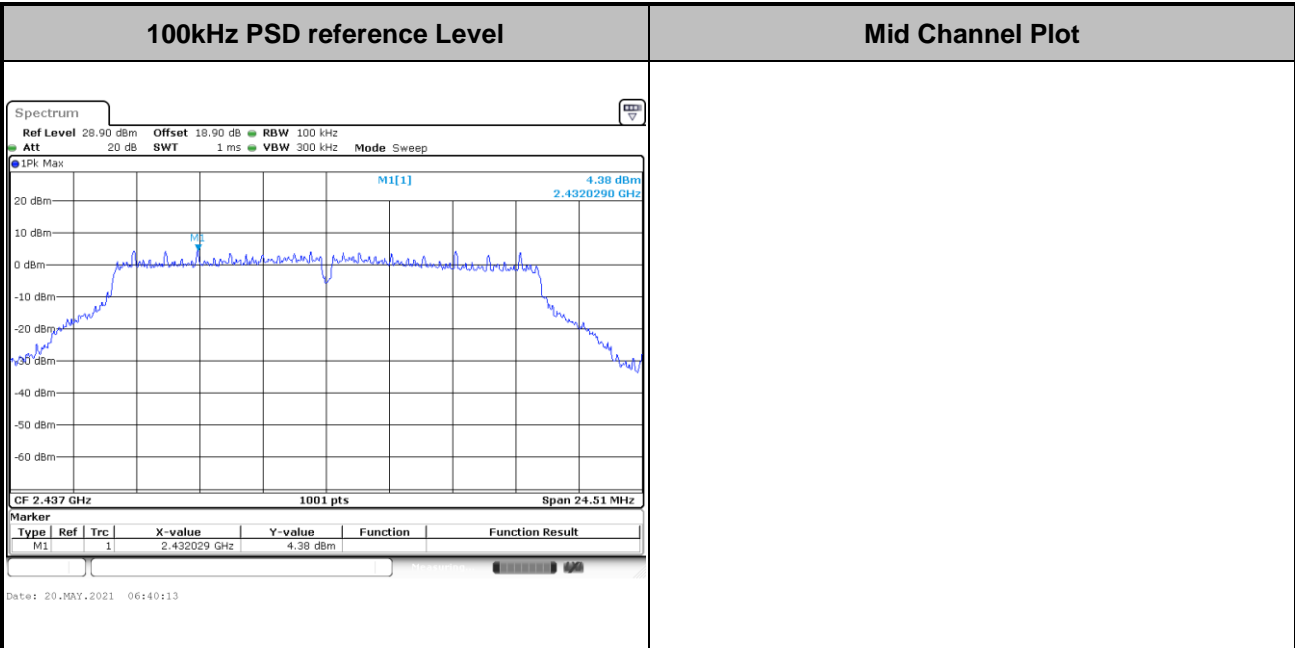


Test Mode :	802.11g	Test Channel :	01
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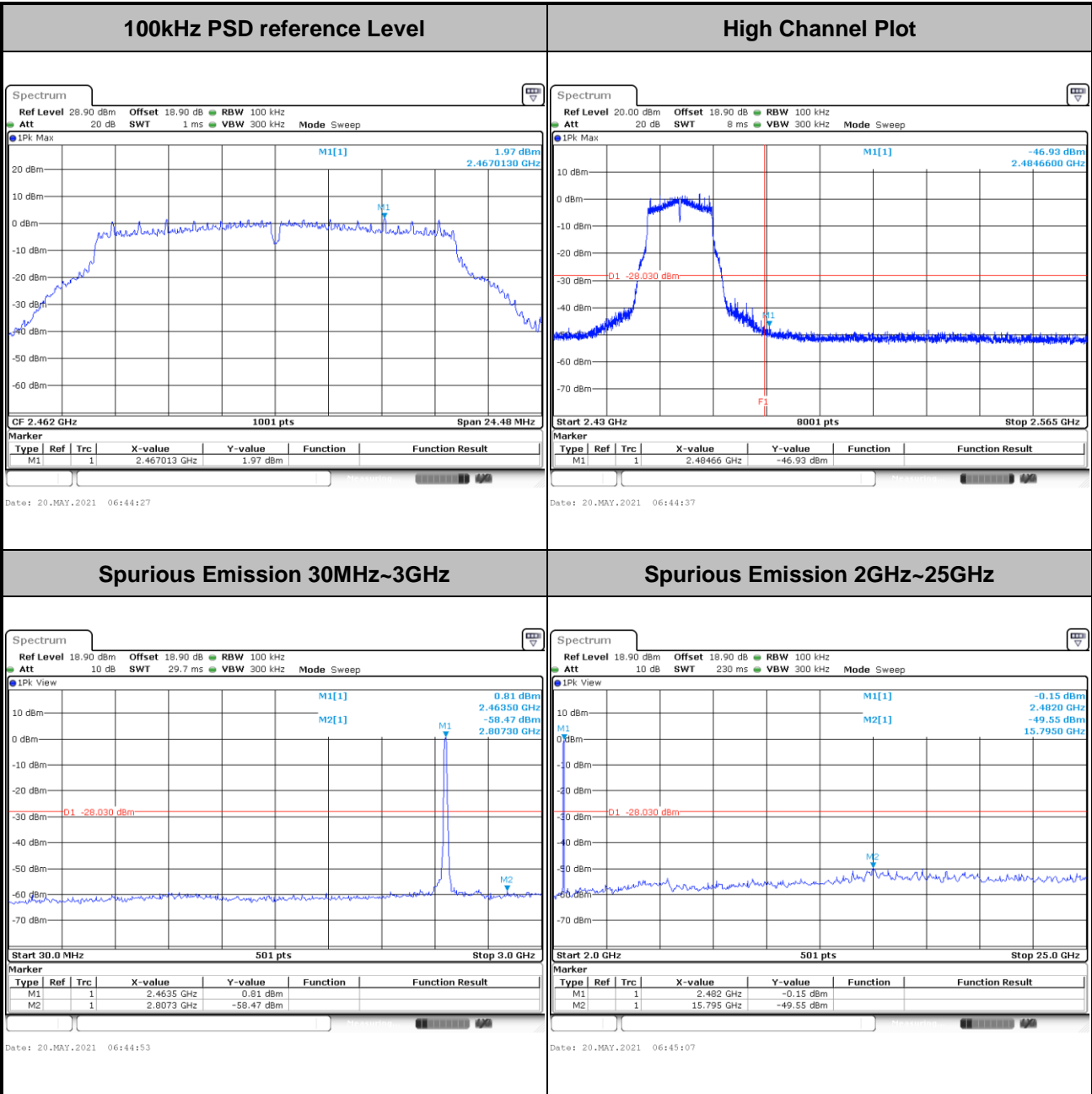


Test Mode :	802.11g	Test Channel :	06
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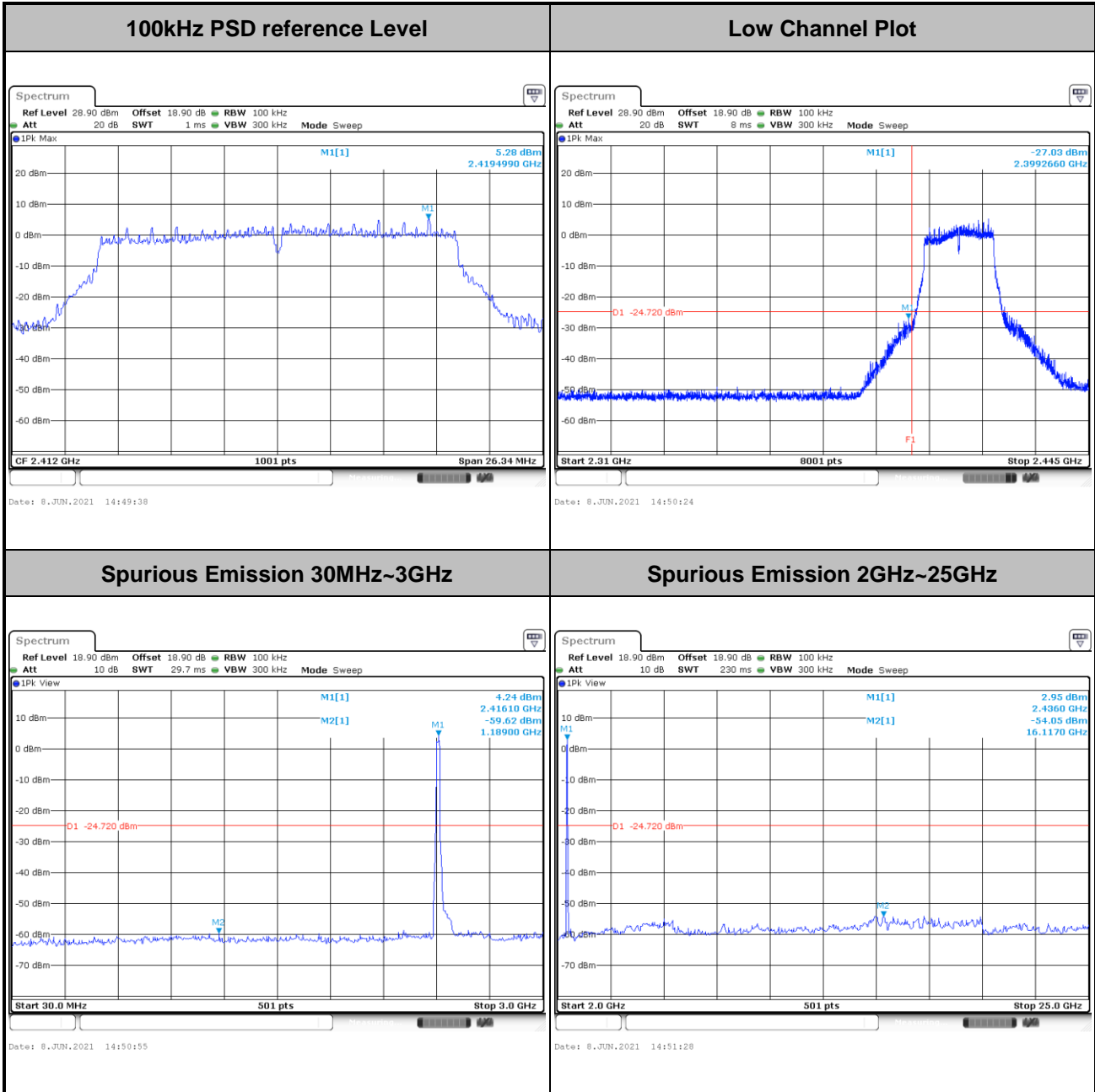


Test Mode :	802.11g	Test Channel :	11
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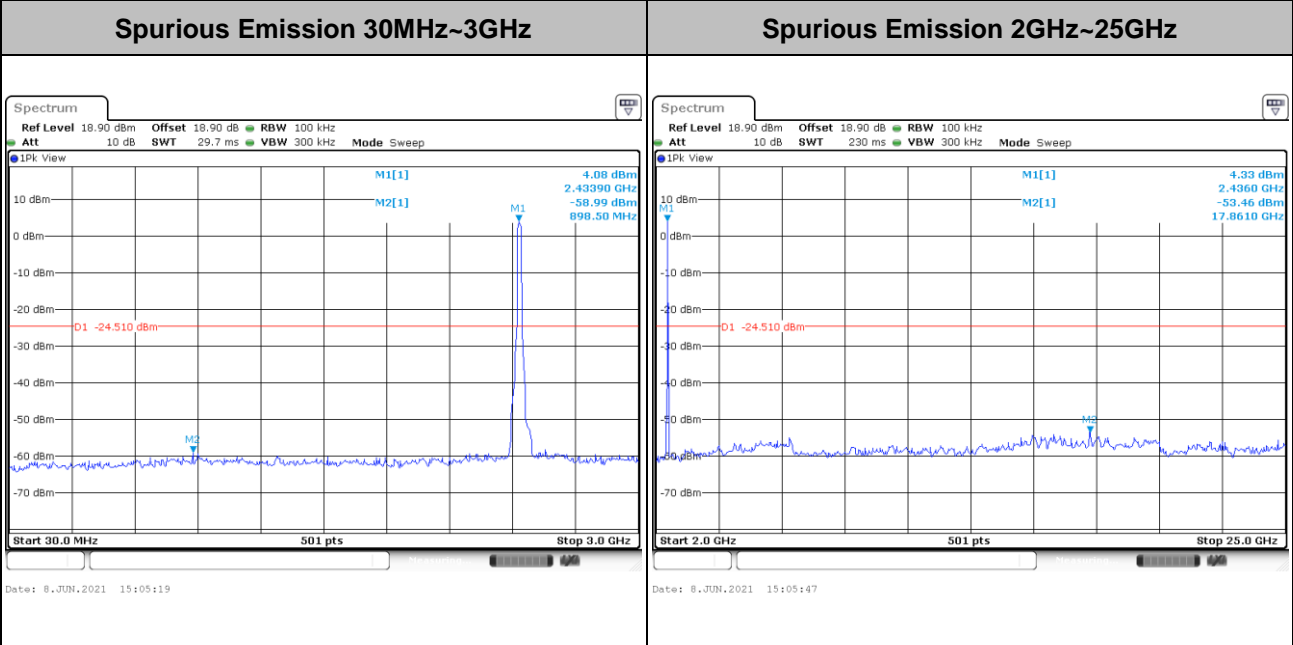
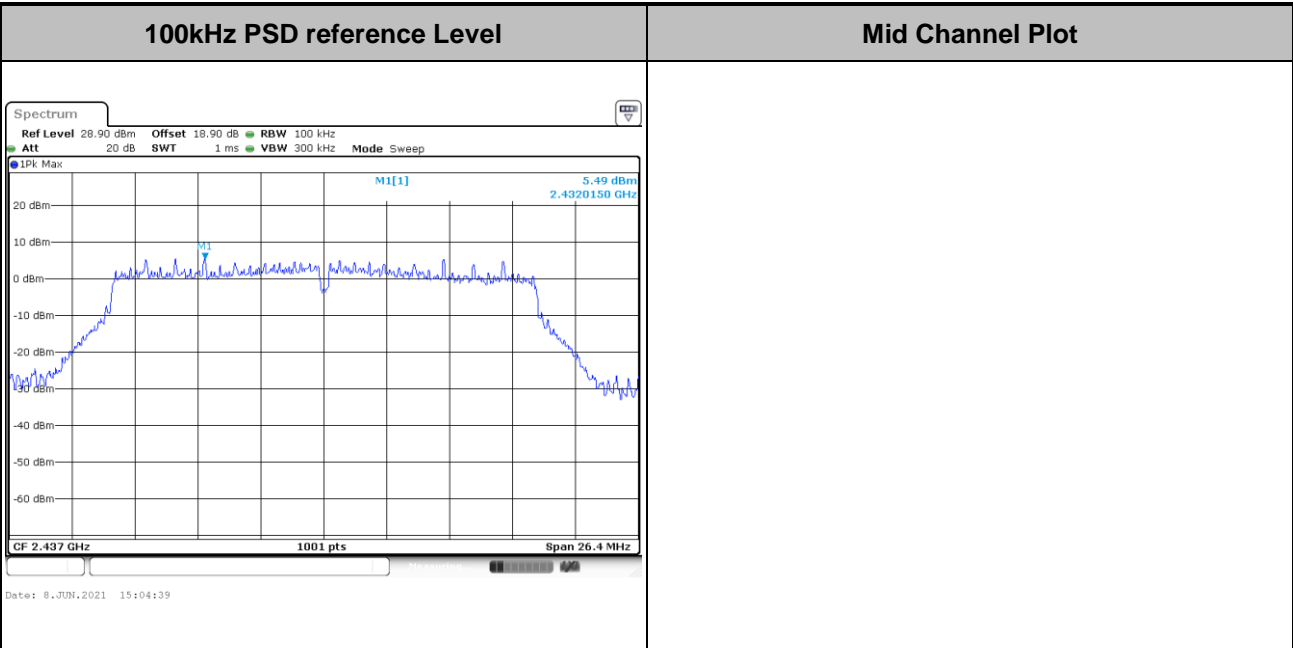
Test Mode :	802.11ac VHT20	Test Channel :	01
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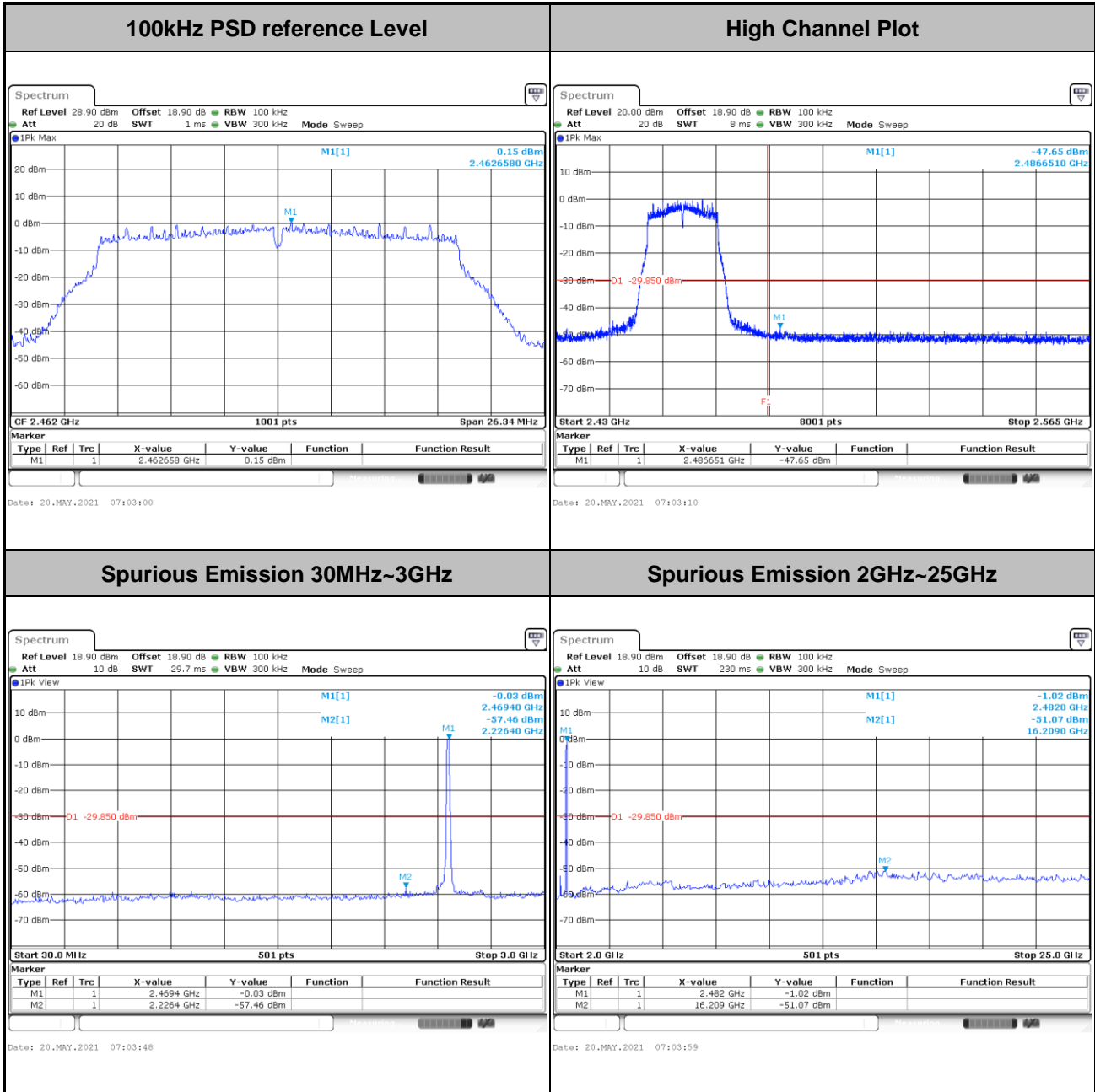


Test Mode :	802.11ac VHT20	Test Channel :	06
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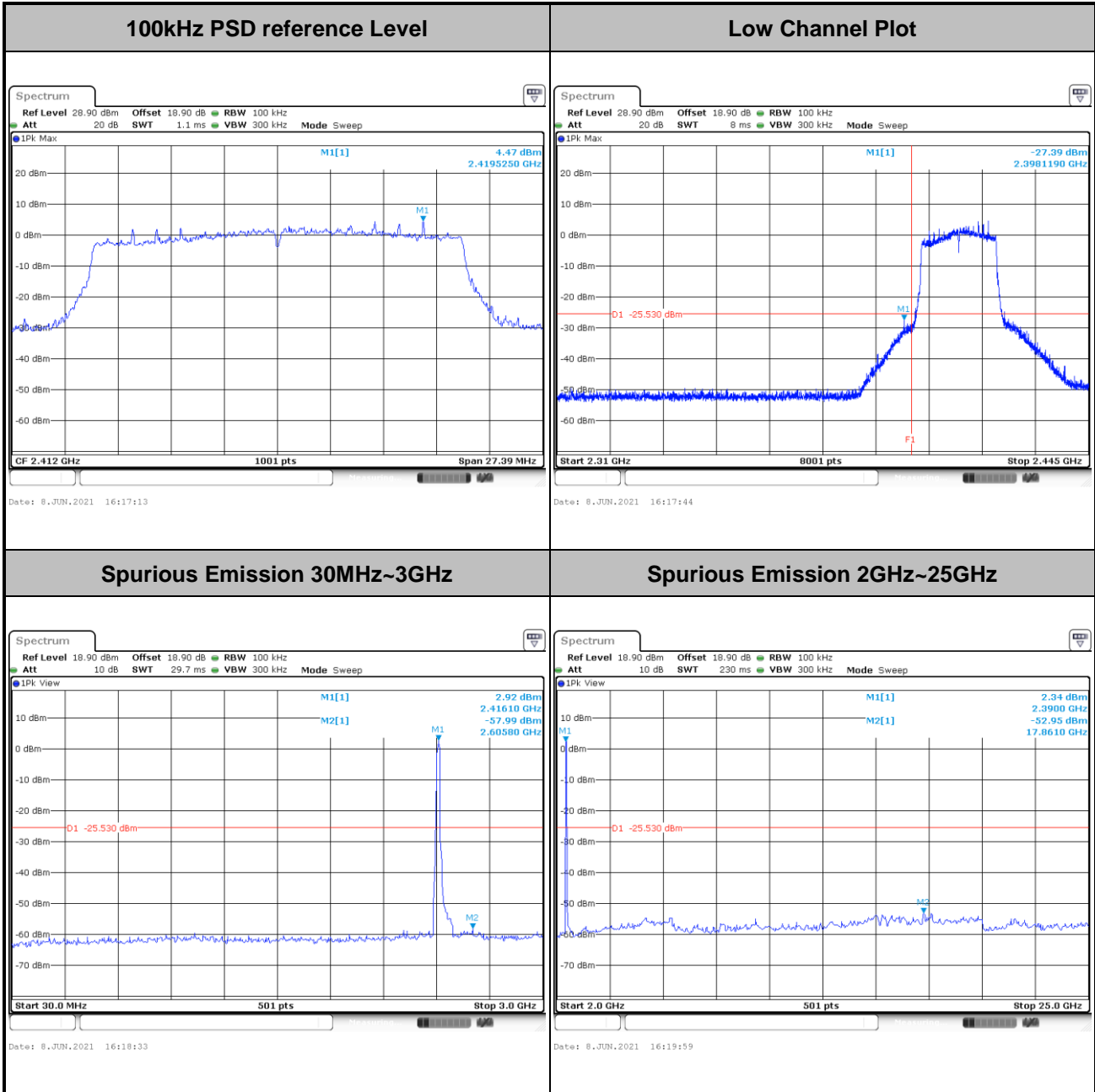


Test Mode :	802.11ac VHT20	Test Channel :	11
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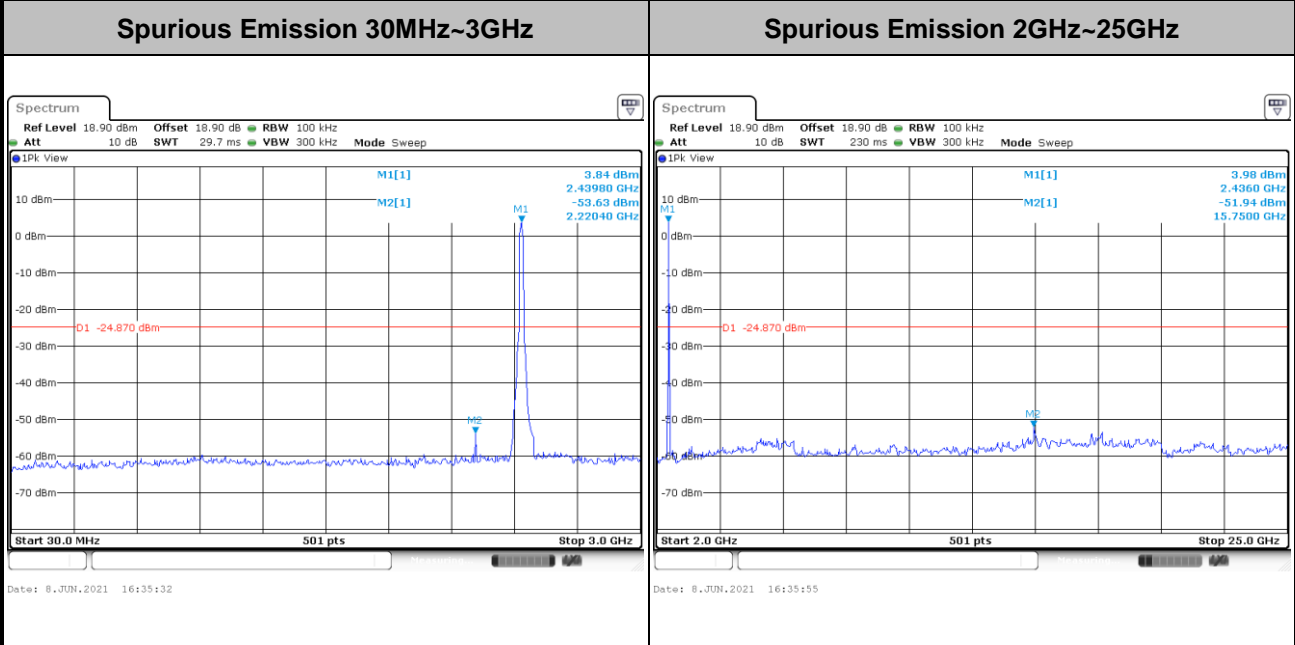
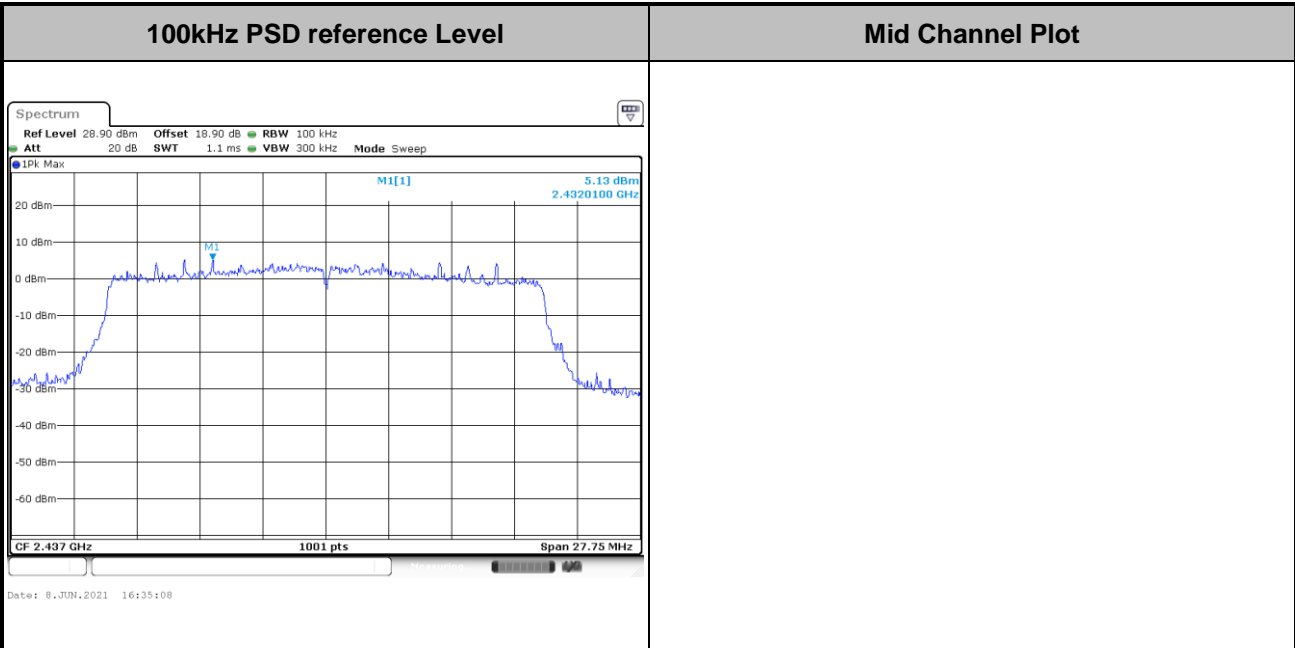


<b>Test Mode :</b>	802.11ax HE20	<b>Test Channel :</b>	01 Full RU
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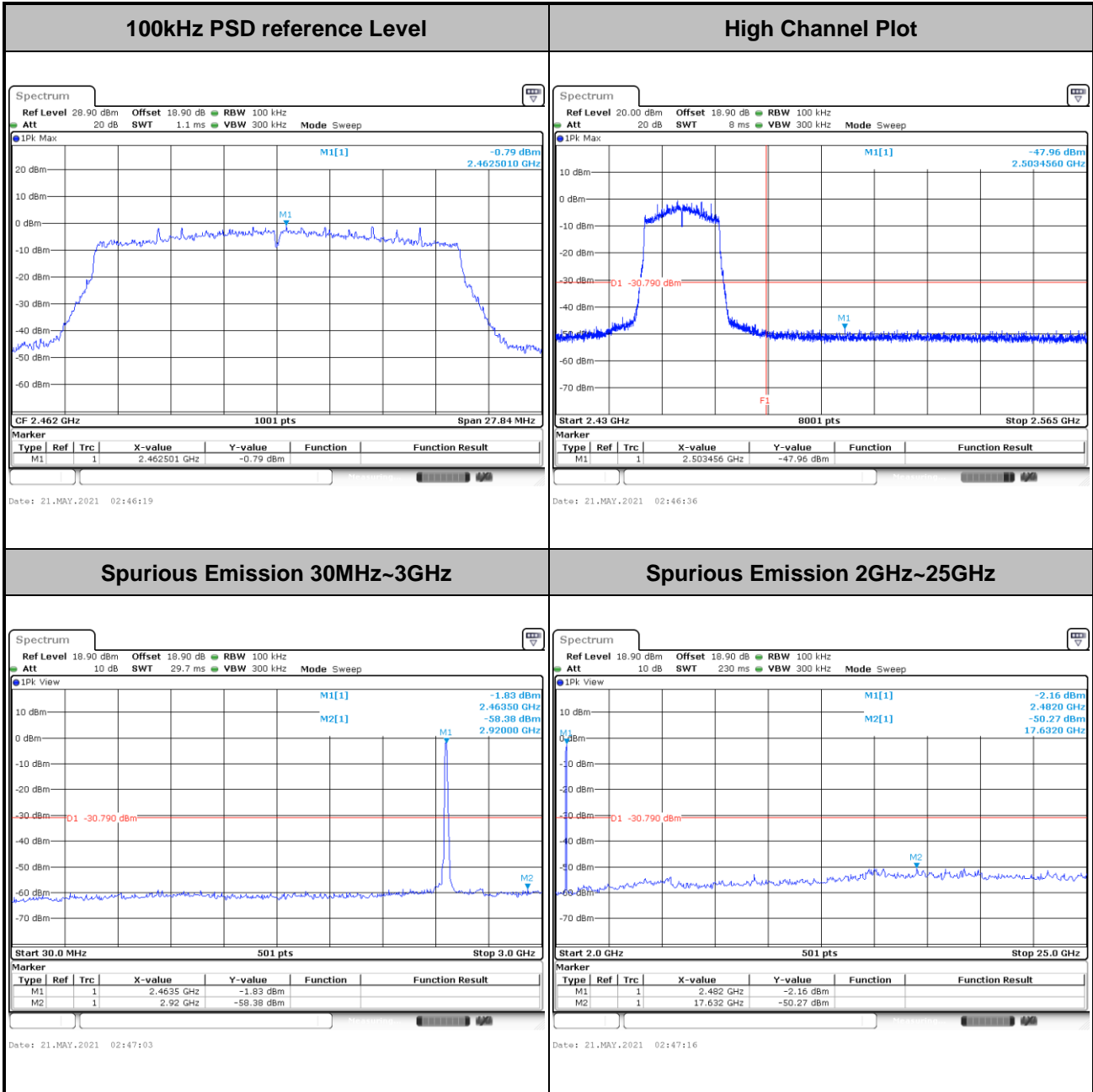


<b>Test Mode :</b>	802.11ax HE20	<b>Test Channel :</b>	06 Full RU
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Test Mode :	802.11ax HE20	Test Channel :	11 Full RU
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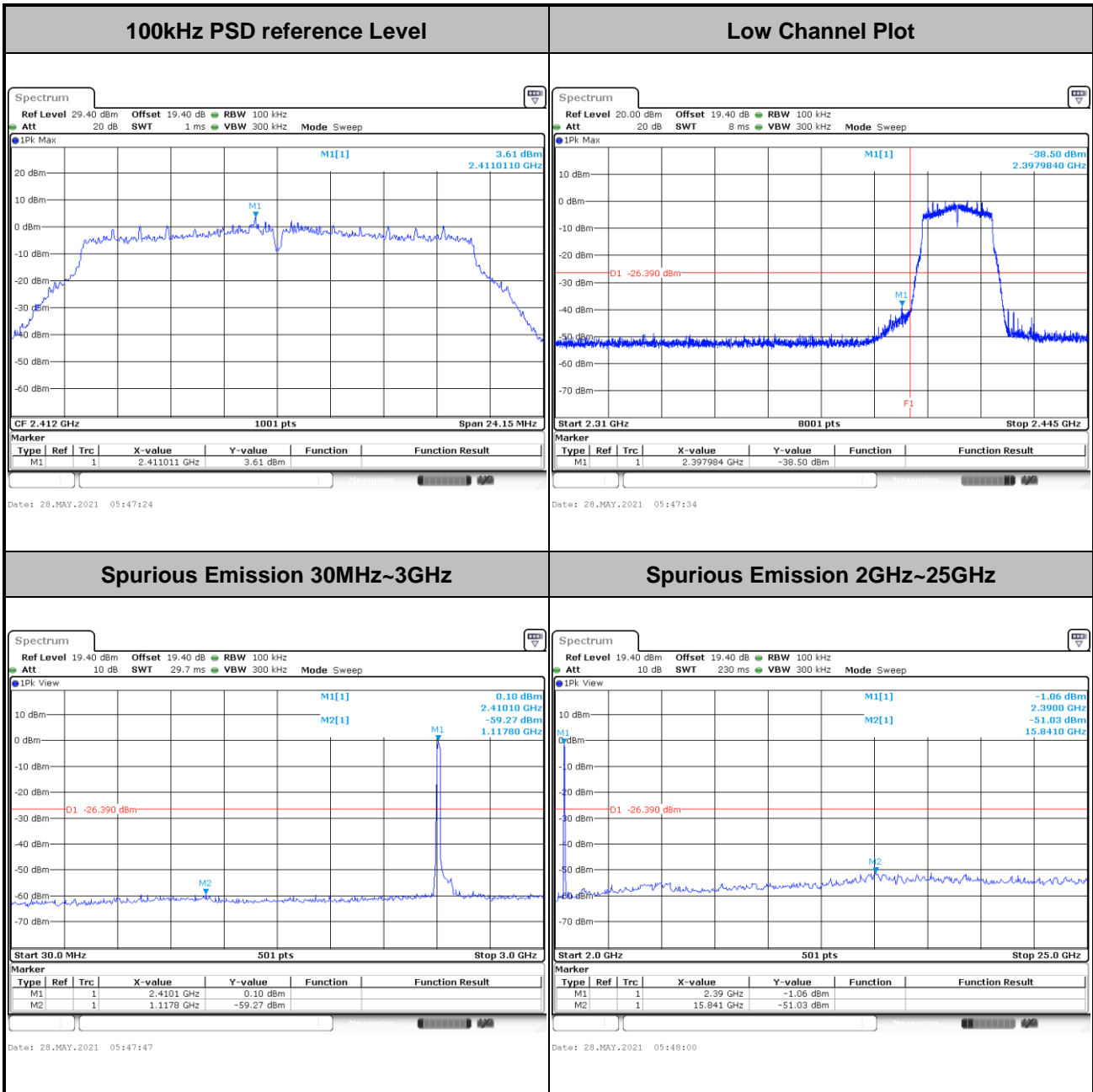


<TXBF Mode>

Test Engineer :	Hank Hsu	Temperature :	21~25°C
		Relative Humidity :	51~54%

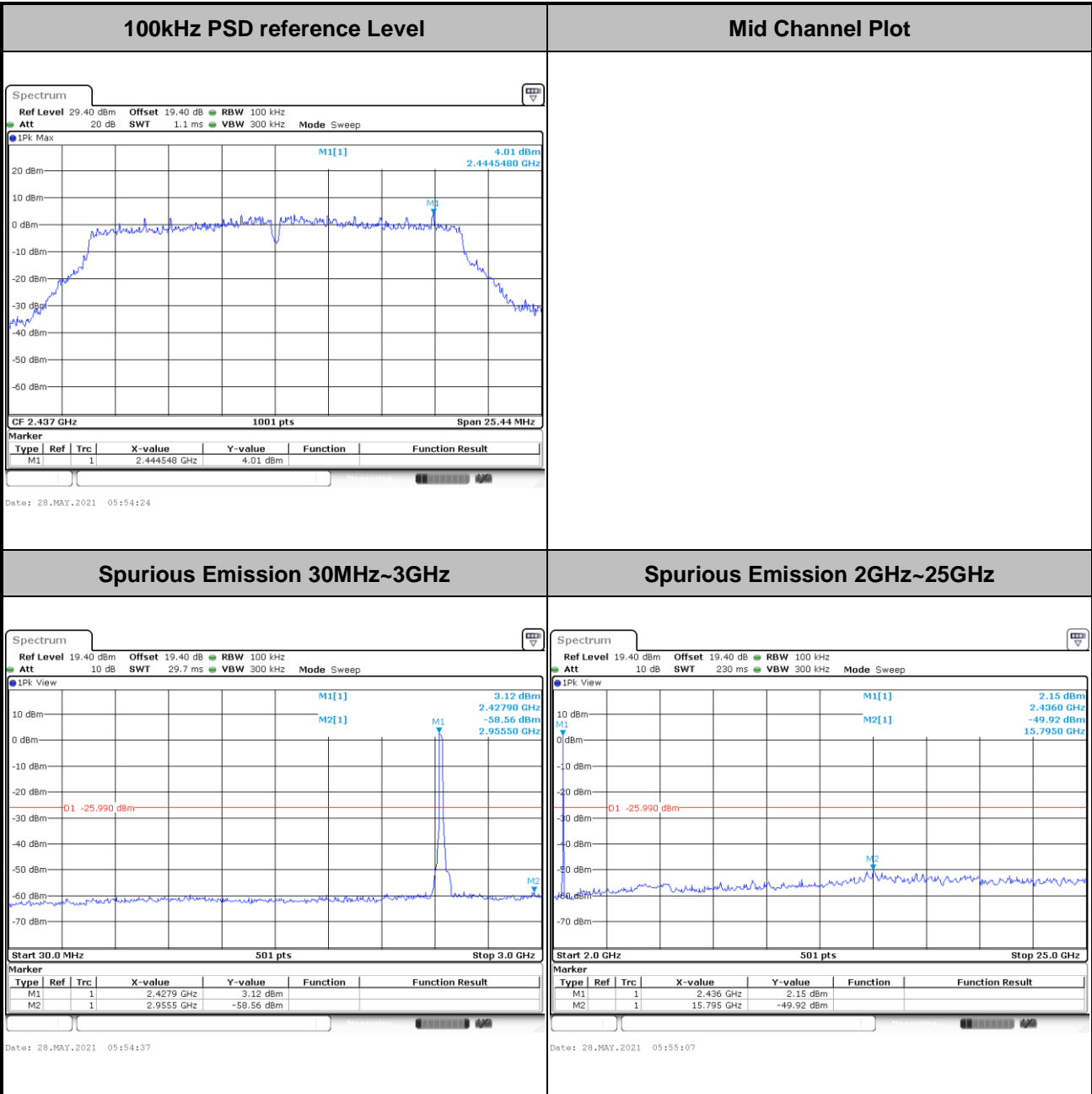
Number of TX = 2, Ant. 1 (Measured)

Test Mode :	802.11ac VHT20	Test Channel :	01
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Test Mode :	802.11ac VHT20	Test Channel :	06
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Test Mode :	802.11ac VHT20	Test Channel :	11
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